AUSTRALIAN
communications
SEPTEMBER 1994 The Networking and Telecommunications Management Magazine $5.50

RE-ENGINEERING THE ENTERPRISE
How to avoid client/server chaos

PCS/PCN
Understanding personal communications systems

DIAL-UP ROUTERS
Long on promises, short on performance

CASE STUDY SPECIAL
How Sweden's SKF moved its SNA traffic onto a global router network

IMPLEMENTING ATM
Early tests reveal plenty of problems

The sweetest results naturally come from the right partnerships.

In Asia and more than 45 countries throughout the world, Telecommunications Administrations and Private Sector Telecommunications Operators have chosen AT&T Network Systems to build and modernise their communication networks. They are relying on our technology, resources and experience to custom-tailor the best possible solutions for their country.

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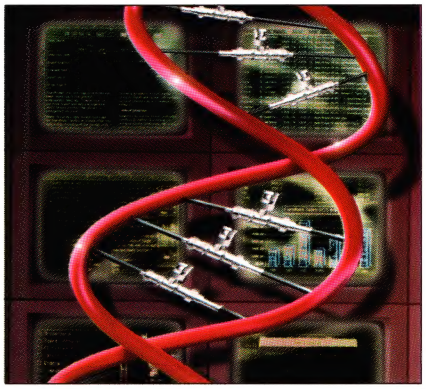

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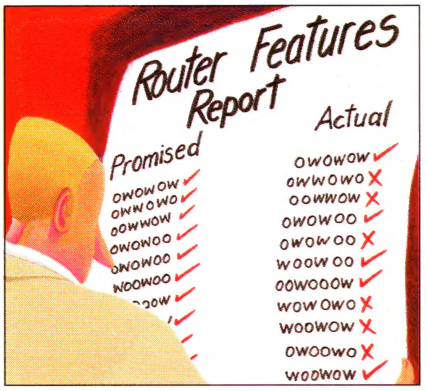

CLIENT/SERVER NETWORKING 65

Re-engineering has been the buzz-word in business circles for a few years now, as corporations reshape their operations to suit the changing business environment. For corporate networkers, in many cases this has meant making the move away form legacy mainframe-based systems to client/server nets. But as many have discovered, the move has not been without some costs, including the loss of the kind of sophisticated integrated management tools found in mainframe environments. In this extended report, we take a look at the issues associated with re-engineering for client/server environments.

PCS/PCN 83

Personal Communications Services (also sometimes referred to as Personal Communications Networks) constitute the latest wave of the communications revolution. The dream is that the technology will enable anyone, anywhere, to be located and contacted by telephone. Some even extend the definition to include the ability to call or be called anywhere, at any time, with any combination of voice, data, image and video services. While all of this may seem fanciful, many certainly believe that wireless 'last 100 metres' systems will probably become the dominant form of telephony in the next century. Stewart Fist explores the technology and its ramifications.

DIAL-UP ROUTERS 91

With the supposed move toward telecommuting and remote working, dial-up routing may be an idea whose time has come. This basic networking need has spurred internetworking vendors to create products that merge existing router technology with today's front-running dial-up products and services. The resulting hybrids are supposed to be cost-effective, reliable, and above all simple to use — key requirements given that these products are most likely to be deployed in places where network managers aren't. Unfortunately, the latest round of Data Comm Test Lab testing reveals that the products currently available often fail to match their promise.

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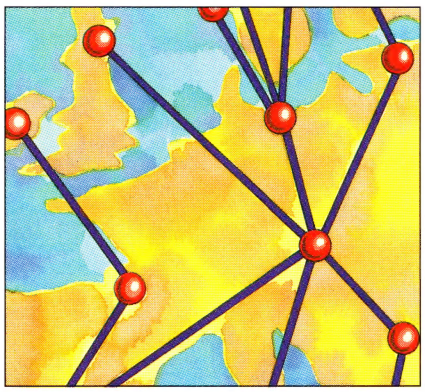
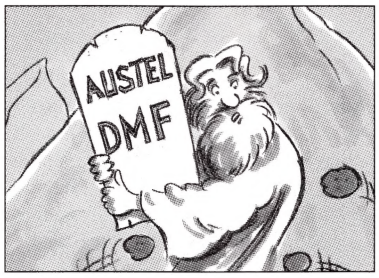


CASE STUDY: SKF 103

Assessing risks and evaluating opportunities is what business is about — whether it's timing the entry into a new market or seizing the right moment to introduce new technologies onto the corporate net. For Sweden's SKF, one such moment came in 1992, when it gave the green light to a redesign that would shut down three of its five European data centres and replace its SNA network with a router backbone. While there's plenty of talk about moving from SNA to router backbones, effecting such a dramatic change involves betting the business. In this ground-breaking report we take a look at how SKF did it, and the problems the company encountered and overcame along the way.

ANALYSIS



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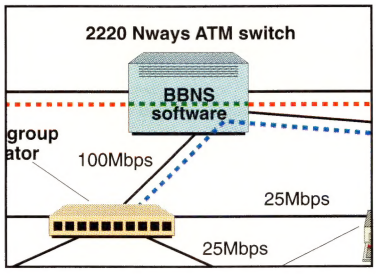

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IBM's ATM product line reaches from the desktop to the enterprise.

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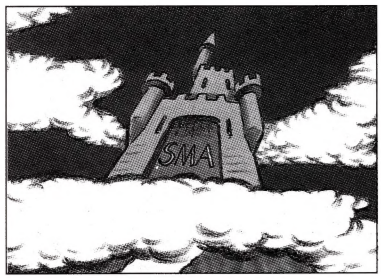
INTERVIEW

55 Bob Donaldson
The Managing Director of Advanced Intelligent Networks for Bell Atlantic International, Bob Donaldson is very much at the forefront of the latest developments in telecommunications networks technology. He spoke with Liz Fell last month.

LEGAL LINE



53 Spectrum Management
The *Radiocommunications Act* is now over a year old, but as yet the only change is uncertainty about what lies ahead. Richard Pascoe looks at the issues now facing the Spectrum Management Agency.

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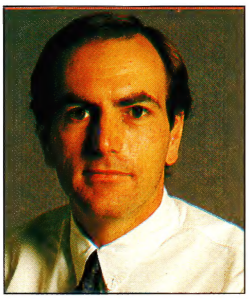
Putting the Cart Before the Horse



Apart from the fairly trite 'headland issues' which hardly needed a group of experts to arrive at, the Broadband Services Expert Group (BSEG) deserves to be congratulated on its interim report. *Networking Australia's Future* identifies what broadband services are and what they could be and it does so with a refreshing clarity and absence of hyperbole. For example, it eschews the dreaded 'information superhighway' metaphor and argues that 'what we are really looking at is a complex web or network of connections — some broad, some perhaps very narrow.' It also concedes that 'subscription television remains the impetus for much of the current broadband developments . . .'

This is a report written by people in touch with the real world and it's hard to argue with their basic thrust that 'the content of communications services is a fundamentally more important issue than the means of delivering them.' According to the BSEG this importance is not always grasped overseas, where many equivalent studies are concentrated on 'technology push' rather than 'market pull' — a point which it considers a weakness and therefore an opportunity for Australia, in that we can seek to 'move ahead of other countries by understanding the applications in their social and organisational context.' After being quick to gain this advantage over dullard foreigners we should then forge the key to the front door of the broadband El Dorado within 'an environment that is conducive to the development of broadband networks, related services and the creation of content.' This 'creative infrastructure' encompasses content creation, network infrastructure development and service provision and fortunately for us most of the elements are here — although some (like engineering) are in better shape than others (like finance).

It all makes sense, and presumably in its second report, where it will look at the much harder question of how broadband services can be introduced, the BSEG will tackle how these creative infrastructure elements can be glued together. I can only hope that in the process it reconsiders its belief that 'demand for services rather than availability of technology should determine the pace at which networks and applications are introduced in Australia.' How do we gauge demand for services which aren't available? By looking at the overseas experience? If we do that then presumably we'll be gauging the demand for applications written for those markets — applications which are unlikely to have been written here because those in our 'creative infrastructure' will still be waiting for a realistic network (i.e. bigger than a trial with a few hundred users) on which to try them out. By the time we've finished cleverly 'understanding the applications in their social and organisational context,' our competitors will be a generation or two ahead. (Comments on the interim report and submissions for the BSEG's final report can be addressed to: The Manager, BSEG Secretariat, GPO Box 2154, Canberra, ACT 2601.)

MA Smeaton

In the October edition of *Australian Communications* . . .

RESALE AND FACILITIES MANAGEMENT

Nurtured by government policy, a whole new service provision industry is developing based around the resale of carrier bandwidth and the management of communications facilities. Next month we examine the state of play.

OVERCOMING CABLING CHAOS

Cabling systems are becoming increasingly sophisticated as network bandwidth requirements mushroom in response to the demands of new applications. Next month we explore cabling quality management.

CASE STUDY: UNIVERSITY OF SOUTH AUSTRALIA

The University of South Australia was formed in 1991 with the amalgamation of two tertiary education institutions. In our next edition we report how the University managed to rationalise its legacy voice and data networks.

FDDI ADAPTORS

ATM, Fast Ethernet and 100VG-AnyLAN are on the horizon, but FDDI is here, it's mature, it's becoming less expensive — and it can deliver 100Mbps to the desktop now. Next month we take a look at the latest FDDI adaptors.

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AUSTRALIAN communications

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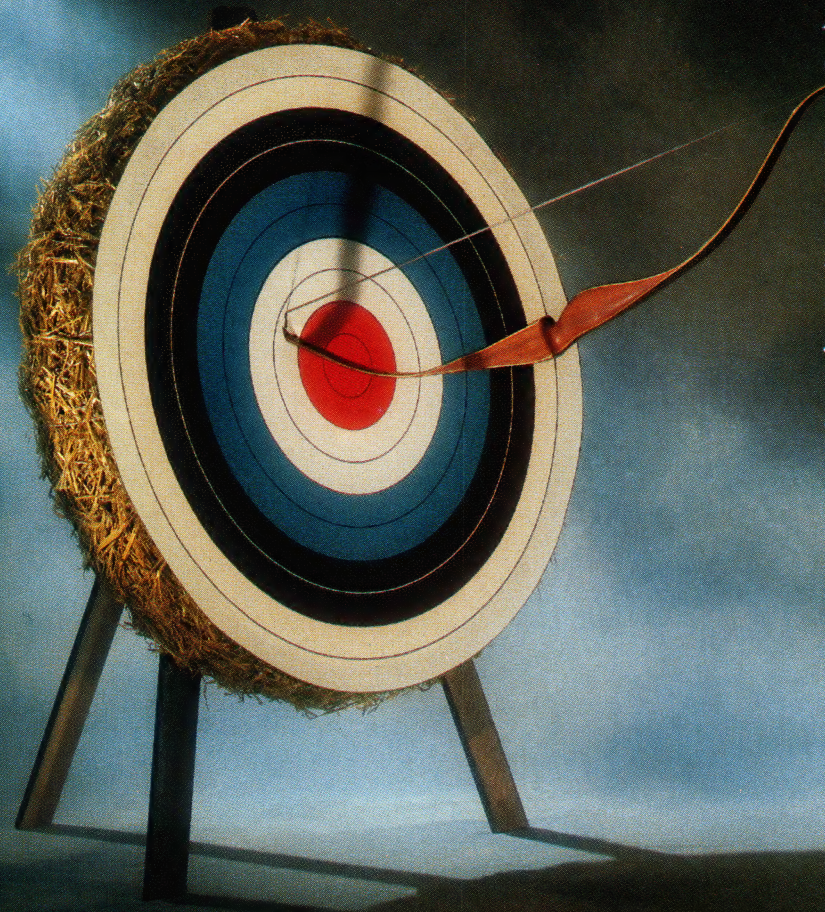
KNOWING HOW TO USE IT IS ANOTHER.



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Broadband Group Emphasises Content Over Carriage

Content — not carriage — is the most important issue in the development of Australia's future communications services. This is the key conclusion reached by the Government's Broadband Services Expert Group (BSEG) in its interim report, *Networking Australia's Future*.

Releasing the report early last month, BSEG head Brian Johns said that while there is "considerable scope" for local companies to help build future communications networks, the Expert Group "believes the content of communications services is a fundamentally more important issue than the means of delivering them." As a result, he contended that the commercial opportunity for Australia lay in fostering a new creative infrastructure for the development of those services.

Established last year to study the impact of broadband services, BSEG flagged six 'headland issues' which it believes hold the key to their successful introduction. In summary, they are that broadband services:

- Will require careful planning and management;
- Are essential for international competitiveness;
- Should ideally be available to all Australians;
- Will provide content opportunities for Australia;
- Should be introduced with Government leadership; and
- Are likely to be delivered by competing technologies.

The interim report addresses what broadband services are and could be, highlights delivery and access issues, and draws attention to security and privacy risks. The more difficult question of how these services can be introduced will be tackled in BSEG's final report, which is due by the end of the year.

Optus Gives Green Light to Cable TV Plans

Optus has formally signalled its intention to enter the local loop service provision market by confirming its joint venture plans with US cable TV giant Continental Cablevision Inc. (CCI).

Optus's Board announced in late July its in-principle approval to begin the construction of a hybrid fibre-coax network to pass two million homes by 1998. Work is expected to start soon on the network, which will encompass local phone calls, Pay TV and interactive services.

Optus CEO, Bob Mansfield, said the CCI-Optus plan meant that "it now looks as though true competition is on the horizon for local telephone calls." The full business case put before the Optus Board suggested "an extremely attractive opportunity for the joint venture to access new revenue streams and, significantly for Optus, also offer us the means by which we can drastically reduce interconnection payments," he contended.

Ownership details of the new joint venture, which is expected to employ around 2,000 people, have yet to be finalised.

Senator Peter Cook, the Minister for Industry, Science and Technology, announced in late July that Alcatel Australia has won contracts worth in excess of $56 million to provide System 12 digital switching exchange equipment to China. Alcatel will supply and install the equipment in the autonomous regions of Tibet (30,000 lines) and Ningxia (70,000 lines) and the province of Gansu (200,000 lines). Alcatel Australia's export revenues for 1993 totalled $218 million, or more than 30% of turnover. The company's total exports to China now amount to more than $100 million and include previous System 12 orders from Qinghai and Heilongjiang provinces. The new contracts will be financed by the Australian International Development Assistance Bureau and the Export Finance and Insurance Corporation.

WA Calls For Facilities Manager

Western Australia plans to follow the lead of Queensland and NSW by handing over the management of its telecommunications requirements to a third party facilities manager.

The call for expressions of interest in the role 'to achieve coordination and lower the total cost of the State's telecommunication needs' follows estimates by government officials that it could cut WA's annual $250 million telecommunications outlay by 40-50%. State Government agencies have already realised savings of $9 million on an annual $60 million expenditure with carriers through a process of joint negotiation.

Pacific Star Communications acts as the Queensland Government's facilities manager, while BT fulfills a similar role in NSW.

Carriers Seal New Interconnect Deal

Austel has announced that Telstra and Optus have agreed on a new interconnection deal which will see Optus pay around 10% more to interconnect with Telstra's network. The agreement covers Telstra's fees to Optus for providing connection to Optus customers via Telstra exchanges.

The interconnection charges were originally set by a Ministerial Determination in 1991 at an average 3.14 cents per-minute-per-end. They were intended to be reviewed when preselection targets were met and Optus had reached a pre-determined traffic share.

Telstra and Optus commenced negotiation on a new deal late last year and after what the industry regulator describes as 'a period of difficult and protracted negotiation,' eventually called upon Austel to act as a 'mediator' rather than as an arbitrator. Austel regards the distinction as important and says the successful outcome of the negotiations without recourse to arbitration reflects the 'commercial maturity' of the carriers.

Optus Wins NSW Mobiles Contract

Optus will provide the NSW Government with mobile phone services as part of a new three-year Strategic Services Agreement. The new deal, which will shave $6 million off the State Government's mobile bill over the period, will see Optus gain around $7 million per annum in increased revenues.

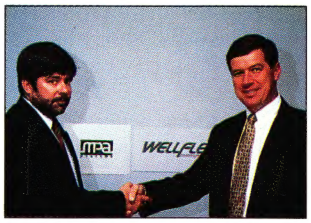
Anne Cohen, NSW Administrative Services Minister, said the mobile services agreement was the first of its kind signed by the NSW Government and the first time Optus has won whole-of-government business from the State. While Telecom has the bulk of the State's $160 million telecoms business, Mrs Cohen said that the agreement provides Optus with the opportunity to win further business in data and long distance services.

New Direction For MPA

After a management shake-up following its purchase by Australian manufacturer, INC, network products distributor MPA International has announced a new direction as an 'upstream systems integrator.' According to this model, MPA will now deal only with systems integrators and VARs, providing them with network and system design skills and the best products and services.

In announcing the new strategy, MPA MD, Phil Ackman, also revealed that the company will now distribute Wellfleet Communications' range of routers and internetworking products in Australia. He said the addition of Wellfleet to MPA's product range, which already includes Banyan and Chipcom, fits well with the strategy because of the strong performance and high level of interoperability of Wellfleet products.

Since its takeover by INC five months ago, MPA has recruited a new management team, more tech support staff, and has opened a new warehousing facility in Sydney. The company is now 40% larger than it was at the beginning of 1994, and has recently posted record fourth quarter results.

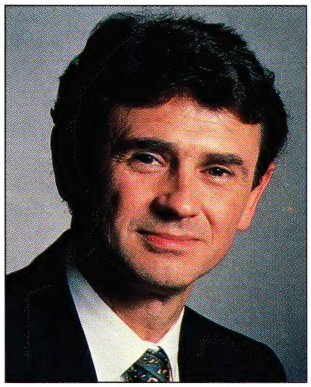


MPA MD Phil Ackman (left) with Wellfleet's David Barker

Burdon Leaves Telstra for BT

Senior Telstra executive, Steve Burdon, has resigned to take up a position as head of BT's Asia Pacific operations.

As former Chief Executive of OTC, and then Group Managing Director, Corporate, International and Enterprises at Telstra, Burdon has spent five years in the top ranks of the Australian telecommunications industry. In his new position at BT he will be responsible for expanding the company's growth in the Asian region. Mr Charlie Zoi, previously Chief Operating Officer, Commercial and Consumer, assumes Burdon's role at Telstra.



Steve Burdon

Ericsson Scores Big PABX Wins

Ericsson Australia has won its largest ever single site PABX contract, securing a deal to supply 5,365 PABX extensions to the University of Sydney's main campus in Camperdown.

The agreement covers the provision of remotely located digital PABX nodes installed at a number of points around the campus, which will be connected via an optical fibre backbone to provide simultaneous transmission of both voice and data. The contract also covers the provision of a voice mail system and call accounting system for management of call costs.

The vendor has also won a contract to provide the Northern Sydney Area Health Service with 4,642 Ericsson MD110 PABX extensions at six North Shore hosptials. The contract involves the replacement of all PABX equipment at the Royal North Shore, Macquarie, Hornsby, Mona Vale, Manly and Ryde facilities, and follows the successful implementation of a PABX network linking eight hospitals in the Hunter region, using optical fibre, public network switching, and microwave.

In Brief

Pacific Star has signed a marketing agreement covering over 500 local authorities in Queensland, New South Wales and Victoria. The company will provide telecommunications brokerage services for the organisations' telephone traffic, which amounts to more than $30 million each year.

Telecom has selected Alcatel and Siemens as contractors for the construction of the $30 million submarine fibre optic cable across Bass Strait. Alcatel will supply and lay cable manufactured at its Botany plant, while Siemens will supply and install advanced SDH equipment, manufactured at its Melbourne facility.

Telecommunications equipment manufacturers have a new industry body, the Australian Telecommunications Industry Association (ATIA). ATIA President, Alcatel General Manager Mr Ron Spithill, said the organisation aims to promote an internationally competitive Australian telecommunications equipment industry.

Ascom Timeplex has won a contract with the Department of Foreign Affairs and Trade to provide LAN/WAN internetworking products, integration and consulting services for the Australian Diplomatic Communications Network, which provide communications between Government organisations in Australia and diplomatic and consular missions overseas.

Christine Goode has been formally appointed as the head of the Spectrum Management Agency.

Stanilite has secured two contracts in the former Soviet Union, which together are worth more than $1 million. The company will provide its Cellswitch cellular telephone systems for installation in Kursk, in Russia, and Alma-Ata in Kazakhstan.

Unisys has appointed a new managing director for its Australian office. He is Robert (Bob) Tway, former group vice president, Southern Group, who will move from his home in Atlanta, Georgia, to take up his post in Sydney on 1 September.

CARE Australia is using Telstra's Satcom-M satellite service in its Rwanda operations to provide a digital voice and fax link for exchanging information between CARE's 10 relief workers and the organisation's headquarters in Canberra.

AT&T has developed, in conjunction with Webster Publishing, a new interactive telephone training tool called BST Direct Voice Terminal Training Package, which provides instruction on how to use the full range of features offered on analogue or digital telephones attached to AT&T Definity PABX systems.

GEC Alsthom Information Technology has announced its accreditation to AS3902/ISO9002, which covers the supply, installation, commissioning, maintenance and customer support of data networks, hardware and software, and associated services.

Telecom has signed a contract with WA-based Magellan Industries for the design and product of 1,467 calibration switches for the Jindalee Operational Radar Network.

The Department of Communications and the Arts conducted Digital Audio Broadcasting trials in Sydney recently. Passengers in a specially equipped bus were able to appraise the quality of DAB transmissions from the University of Technology and ABC Classic FM whilst following a route through the city's hilly terrain. DAB technology promises to deliver 'CD-quality' sound, with fewer transmission impairments than either AM or FM systems.

Optus has given over 300,000 of its customers a gift in the form of a rebate on their long distance phone bills. The company has reimbursed a total of $9 million to customers, as a way of thanking them for their support during the company's past year of operation.

Cabletron Systems has announced that Cray Communications will no longer be a reseller of its products in Australia. Cray customers should contact Cabletron for sales and support advice.

AWA has closed two of its networking unit offices and has ceased distribution of imported products to concentrate on the development of home-grown technology. The decision caused the retrenchment of around 15 staff.

Scitec Communication Systems has sold 40 of its FastLane voice/data multiplexers to San Miguel, a food and beverage producer and distributor and the Philippines' largest company. The sale represents Scitec's first major push into the Asian market.

In Brief

BT is to shed another 50,000 jobs as part of its ongoing restructuring programme. Scheduled to take place over a five-year timeframe, the retrenchments follow the cutting of some 90,000 positions already, as BT pursues its goal of pruning its workforce back to 100,000 employees to make it more competitive.

Ericsson has won a contract worth up to £140 million for the expansion of Mercury One-2-One's mobile communications network. The deal covers all elements of network infrastructure equipment as well as new technology which can significantly extend the range of radio cells. It will facilitate the network's expansion out of London to Birmingham.

Motorola has announced that Indonesia's PT Indolink First Pacific has purchased and installed the company's FLEX paging equipment. Valued at $US1 million, the order follows Motorola's $US7 million sale of FLEX equipment to Singapore Telecom in July. Indolink launched its new service on August 1.

AT&T has signed a deal with Philips Kommunikations Industrie AG whereby the German company will supply GSM base station systems for AT&T's global GSM offering.

Chipcom has bought California-based David Systems, a vendor specialising in the stackable Ethernet hub market with a strong R&D background in 100Mbps Ethernet technologies.

Wellfleet Communications has announced a 113% increase in revenues to $US384.2 million for its fiscal year ended June 30. Net income increased from $US27.8 to $US 61.1 million.

Russia's first GSM mobile phone system has gone into operation in Nizhny Novgorod (formerly Gorki), 400km east of Moscow. The system, implemented by Alcatel and based on the Alcatel 1000 System 12 switch, will initially support 2,000 subscribers.

Alcatel's German subsidiary, Alcatel SEL, has won a contract worth over $17 million to supply Alcatel System 12 digital exchanges to the Philippines Long Distance Telephone Company.

MCI will provide an international phone service between the recently reconciled states of Israel and Jordan, enabling residents of the two countries to communicate by phone for the first time.

Hong Kong Telecom has joined AT&T's Worldsource alliance, and will begin offering Worldsource services, including virtual network voice and data services, frame relay services and private line data services, in early 1995.

GPT has received its largest ever order ever for Gem payphones. The company will provide Mexico's Telecommunicaciones Publicas y Privadas de Mexico with £1.83 million worth of equipment.

Philips Communications Systems will provide 622Mbps SDH transmission equipment to Indonesia's Indosat. The equipment, to be installed in Jakarta, will have the capacity to transmit over 7,500 simultaneous calls over a single fibre.

Telstra is believed to be competing with BT, Vodafone, Motorola and Champion for the right to partner Indonesian PTT PT Telkom in the operation of a regional GSM cellular network.

Slovakia will privatise its telecommunications sector, transforming the state-owned company first into a state shareholding and then gradually inviting foreign investment. Siemens, Alcatel and Northern Telecom are all believed to have expressed interest.

UK operator Cellnet has launched its GSM network, promising customers the ability to make and receive calls in 15 countries. The new network, which cost the company some £300 million to install, provides coverage to 90% of Britain's population.

Ericsson is to supply nine ATM switches to Swedish operator Telia for a new network in Helsingborg, in southern Sweden.

Bell Atlantic has moved to acquire a 42% interest in Mexico's largest independent provider of wireless communications, Grupo Iusacell. Iusacell holds a concession to operate a cellular service to the four central regions of Mexico.

Cisco Systems has has formed an alliance with 13 leading Japanese technology companies in a joint venture designed to develop and expand the emerging Japanese internetworking market. Alliance partners include Fujitsu, Hitachi, Mitsubishi Electric, NEC, OKI, Toshiba, Compaq and Sega.

TCNZ Reports Strong Growth

Telecom Corporation of New Zealand is expected to report a profit for the year of $NZ600 ($495 million), after announcing earnings of $NZ138.5 million for its first quarter.

The strong quarterly result represents an increase of 17.2% over the corresponding period last year, attributable both to healthy earnings on key business and good results from new areas like 0800 numbers, Smartphone services, and call waiting services. Cellular revenues also rose by around 20%, with connections increasing by 46.4%.

The results also reportedly reveal a strong performance by TCNZ's 51%-owned Queensland-based Australian subsidiary Pacific Star Communications, which lifted its total operating revenue by 62% to $NZ37 million.

Meanwhile, TCNZ has been rapped over the knuckles over its treatment of rival Clear Communications in a dispute about the awarding of non-code access. Arbitrator Sir Duncan McMullin ruled that Telecom had abused its market dominance to keep Clear from gaining access to a substantial part of the telephone network, finding that TCNZ had procrastinated in negotiations once Clear had reached its previously agreed minimum market share of 9%.

NT Seals Sprint Supply Contract

Buoyed by recent strong financial results, Canada's Northern Telecom (NT) has signed a deal worth several hundred million dollars with US carrier Sprint to supply a wide range of equipment for the carrier's local and long distance operations.

The equipment, which will include new DMS switches and custom-designed long distance software, will provide Sprint with a range of new service capabilities including high-speed data transfer and CLASS services such as Caller Identification and Advanced 800 services. The supply agreement extends through to until 1996, company officials said.

With last year's heavy restructuring costs out of the way, Northern Telecom has bounced back to profitability and recorded a 14% boost in revenues to $US2.12 billion and earnings applicable to common shares of $US37 million for the quarter ending June 30, 1994. Net earnings for the six months to June 30 were posted at $US124 million, compared to a loss of $US954 million for the corresponding period last year.

EC Finally Approves BT-MCI Deal

The European Commission has finally given the go-ahead to the BT-MCI alliance, making it the first strategic global telecommunications alliance to be given legal clearance by the European organisation.

Under the competition rules laid down by the EC Treaty and the European Economic Area Agreement, the companies have agreed that BT's exclusive distribution agreement concerning joint venture company Concert's services in the European Economic Area (EEA) will not prevent a user obtaining the services through MCI. Provisions in the initial agreement on BT's exclusive distribution rights excluded MCI from seeking customers in the EEA.

In related news, both Ericsson and Northern Telecom (NT) have received orders from Concert for the supply of switching equipment. Sweden's Ericsson will supply AXE-10 exchanges for Concert's Service Switching Points in London, New York, Frankfurt and Sydney; while Northern Telecom will supply its DMS-250 switching equipment. The equipment will form the backbone of Concert's Virtual Network Service.

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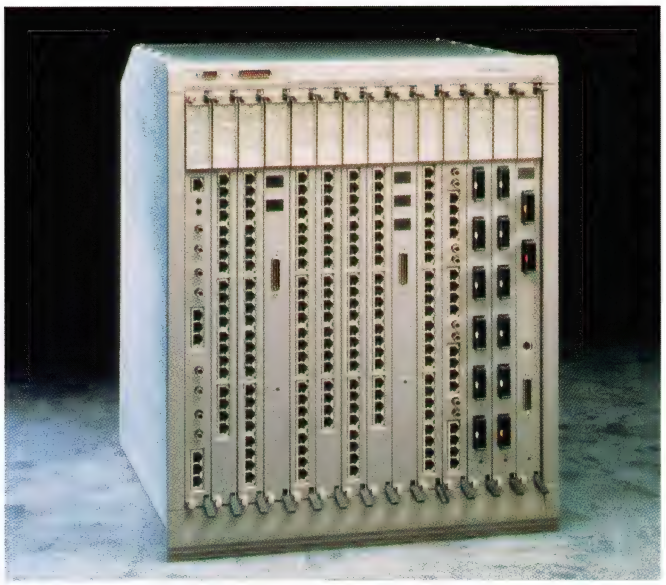

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Bringing Down the DMF

Draft approaches to Austel's proposed Decision Making Framework have stirred a new round of industry unrest.

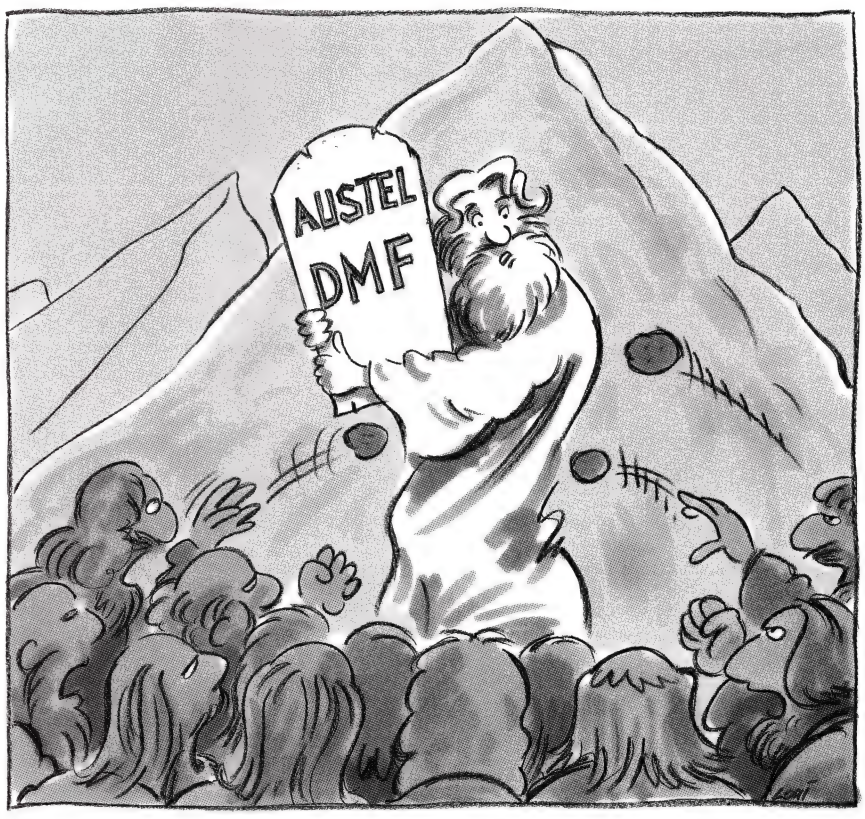
The foundations of Australia's telecommunications regulation are now crumbling. In hindsight perhaps the load they have to bear could have been better anticipated, but it is too late for that now. What Austel must do is ensure that they at least hold together well enough until major structural reworking takes place in 1997 and, ideally, be able to serve beyond the end of the fixed network duopoly with minimum modification. This requires:

- Preventing the existing licenced carriers from abusing the privileges associated with their licences when operating in markets that are open to competition;
- Preventing Telecom from abusing its inherited dominance of the market;
- Attempting to keep regulatory change in line with the recommendations of Professor Fred Hilmer that Australia should aim to have as little industry-specific regulation as possible; and
- Attempting to foster competition from service providers in accordance with the intent of government policy and within the limits prescribed by the legislation.

This latter point is proving to be particularly difficult. Whilst the 1991 Act was designed to foster competition by opening all telecommunications services to competition except the right to install and operate transmission capacity, it failed to define any category of person or organisation that could reasonably be called a competitor. In the Act there are only licenced carriers and their customers. And, except in certain special situations, a licenced carrier is not permitted to discriminate between different customers, be they the average citizen with their single phone line, or the largest corporation in Australia.

Telecom has pushed to hold on to its dominant position. As a consequence, controversy has dogged the legislation. There was first of all the long running disputation over basic versus enhanced services, followed by allegations that Telecom tariffs, in particular its Strategic Partnership Agreements (SPAs), breached the Act's prescriptions against discriminating on price between different classes of customers.

Austel, temporarily at least, solved the basic services issue with its Basic Carriage Services (BCS) Opinion of October 1992. Amendments to the *Telecommunications Act* earlier this year were intended to solve the price discrimination issue and they forced the withdrawal of the SPA tariffs.



These amendments also gave Austel greater powers to prevent a repeat of the SPA debacle by disallowing tariffs of a dominant carrier 'that have or are likely to have a material and adverse effect on the development and/or maintenance of commercially sustainable competition in a market.'

A Ministerial Direction, The Telecommunications (Price Discrimination) Direction No. 1 of 1994, gave Austel indications on how to perform this function, and required it to test for anti-competitiveness if certain circumstances existed. It also required Austel to develop a Decision Making Framework (DMF) to assist it in forming opinions in these matters. Austel decided to kill two birds with one stone and come up with a framework that would prevent a repeat of the long running BCS controversy. And that was when the trouble started.

Anyone Got a Better Idea?

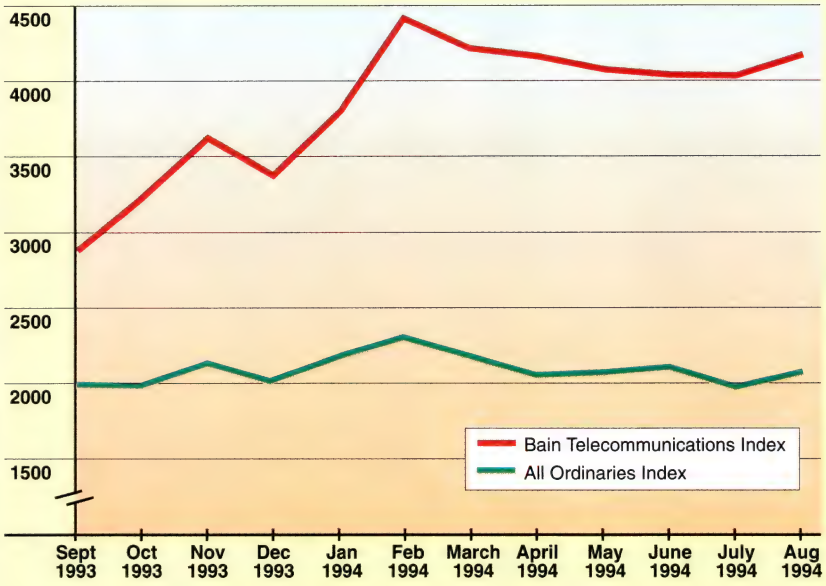
Austel engaged local and overseas consultants to help it develop the DMF and a methodology for dealing with the anti-discrimination pricing rules. On 9 May Austel called an initial public meeting to outline its approach, to introduce its consultants and to invite comment and input from interested parties. But on 20 June the proverbial hit the fan when at a public meeting in Sydney, the consultants presented their initial findings and recommendations on the DMF.

"It will inevitably lead to timed local calls" said one lawyer. "Fatally flawed and quite unworkable" said one consultant. The whole meeting was described by one attendee as "like something out of Lewis Carroll." It was suggested that the proposed DMF, if adopted, would have policy implications quite beyond Austel's official responsibilities.

Following the 20 June meeting the consultants provided an interim report to Austel, and Austel held a third public meeting on 20 July, this time in Melbourne, at which extracts of the interim report were presented along with Austel's initial views on the consultants' approach. But Austel was already said to be backing down on the most controversial aspects of the report.

At the time of writing Austel was preparing another report. This time it will be Austel's views rather than those of the con-

Stock Watch



The Bain Telecommunications Index (BTI) includes only those public companies which derive the majority of their earnings from the telecommunications sector. It is calculated in the same fashion as the All Ordinaries Index and is maintained by the Australian Stock Exchange Index Office. The formula is:

$$\text{Today's Closing BTI} = \text{Yesterday's Closing BTI} \times \frac{\text{End of Day AMV}}{\text{Start of Day AMV}}$$

where AMV refers to Aggregate Market Value - i.e. total market capitalisation. The start of day AMV is the previous day's end of day AMV and is adjusted for any changes in the BTI such as additions, capital reconstructions, rights issues etc. This ensures that any movements in the BTI are the result of trading activity in that day only.

Company	Market Capitalisation $M	Performance %	Share Price ($) 1/8/94	52 Week High	52 Week Low
AWA	169	22.1	0.83	1.02	0.66
Datacraft	119	311.1	1.11	1.18	0.27
ERG Australia	438	85.8	3.34	3.70	1.63
Exicom	71	-17.6	0.70	1.40	0.50
JNA Telecommunications	72	-6.9	2.42	3.40	2.08
Matrix Telecommunications	118	73.8	2.45	3.65	1.28
NetComm	7	N/A	0.67	1.40	0.55
Scitec	35	309.5	0.43	0.51	0.11
Stanilite Pacific	210	103.7	7.15	7.21	3.61
Techniche	86	108.5	4.90	6.50	2.38

Market capitalisation is the share price multiplied by total ordinary shares on issue.
Performance is the percentage share price movement over the past 12 months.

Source: Bain & Company

sultants, in preparation for a fourth public meeting in Sydney on 17 August. All the publicly available information to date has been primarily the consultants' views of what Austel should do.

At the core of the consultants' proposal is a supply side approach to telecommunications markets. This, they hope, will avoid all the problems with the original BCS controversy which arose because services were framed in terms of 'demands' for end-to-end services such as a telephone call. The new approach identifies three basic 'supply side' network services (BNS) from which end-to-end services can be constructed.

- The basic customer connection (BCC) (e.g. local loop or mobile to base station);
- Switching services; and
- Inter-exchange transport, including tandem (trunk) switching.

From these three BNS the consultants derive five markets which would be covered by Austel's DMF: the originating and terminating BCCs; switching at the first possible point of interconnection; inter-exchange transport to an actual point of interconnection; carriage between the actual points of interconnection.

They then argued that the customers on each carrier's BCC represent a market over which that carrier has dominance (for example, Vodafone dominates the market for the BCC to Vodafone mobile customers). Therefore provisions of the Act covering situations where a carrier is in a position to dominate a market need to be applied to this component.

Under the consultants' proposals carriers would be required to develop flag prices for each unit of BNS usage. This will enable the tariff of any end-to-end service to be examined by reference to the flag price of the BNS components of the service, they say. 'The flag prices in conjunction with the proposed allocation of residual costs associated with a retail service and appropriate transfer pricing rules, can be used to determine tests which will examine whether the dominant carrier's prices are too high or too low via the application of rules which impose a ceiling to limit monopoly rent (and) set a floor price below which prices are considered predatory.'

Sounds simple doesn't it? It's not. A big question (yet unanswered) is how these pricing rules will be drawn up. According to one consultant the whole concept "represents an extraordinary regulatory intrusion into Telecom's pricing behaviour and seeks a level of cost information that far exceeds that sought by any other regulator."

Because of the 'bottleneck power' that each carrier has over the BCC to its customers it has also been argued that Telecom would be unable to negotiate commercial interconnect deals with resellers, but would have to supply them interconnect at the same rate as other carriers. Austel denies this.

In a statement aimed at clarifying some of the major concerns raised about the consultants' interim report, Austel said: 'The DMF model accommodates carriers interconnecting with each other under more favourable terms and conditions than with others and this is a feature of the proposal. The model does not seek to undermine the carriers' position in this regard.'

Others have reached the opposite conclusion. In a press release welcoming the DMF proposal and pledging its support, the Service Providers Action Network (SPAN) said: 'If Austel's proposals are adopted all competitive service providers will be given access to these three basic services at exactly the same price and under the same terms and conditions. This is the only fair way to ensure that competition, especially against Telecom, is fair and equitable . . . The

carriers still have a number of rights denied to their non-carrier competitors and there is no justification for their also being given pricing advantages in the supply of these basic network services.'

Both cannot be right, and as Austel heads for what many believe will be a major backdown on its DMF, there are suggestions that service providers' concerns will be dealt with in another vehicle, the Service Providers Enquiry.

Austel has now decided to undertake a study of the service provider industry 'to determine whether it is evolving in accordance with Government policy objectives.' So far Austel has only reviewed service provision from the rather narrow perspective of international resale and Telecom's National Connect tariff, the tariff for the most serious service providers with the $1 million entry fee, which only AAP Telecommunications has taken up.

Service providers are an essential component of the Government's vision for telecommunications competition, both pre and post 1997. The second reading speech on the 1991 Telecommunications Bill stated that the policy intent of the Bill was to provide 'a framework for fostering competition among all service providers consistent with fostering sustainable network competition.'

In a separate but not unconnected development in July, Austel announced that it had successfully mediated negotiations for a new interconnect rate for Optus's use of Telecom's public switched network. The Act provided that the initial rate, set by Austel with the intent of helping Optus get a start in the market, would be replaced by a new commercially negotiated rate once Optus's market share passed certain thresholds. Full details of that commercially negotiated rate were not revealed but what was revealed was that it was on average just 10% above the initial rate of 3.14 cents per end per minute. By comparison, AAP Telecommunications pays over eight cents per end per minute.

Even if carriers are supposed to be given preferential treatment over service providers the discrepancy between these two rates seems hardly conducive to fostering healthy competition and a growth in the service provider industry. So it is no wonder that SPAN would like to see a flag price set for the BCC which was charged equally to all.

Stuart Corner is the Publisher of Exchange and Telenews Asia.

Convergence

Plenty of Twists in the Local Loop

It may not be fair to characterise their actions as 'leaving a sinking ship,' but something is going on in the Packer-Murdoch-Telecom (PMT) consortium to make Packer and Murdoch take the plunge. Kerry Packer jumped ship a few months back, buying a 15% Optus stake. Continental CableVision was later rumoured to be adding a further $2 billion to the Optus Pay TV pot, and at the time of going to press Murdoch was said to be talking to Optus and Continental, and is 'more likely than not' to join the venture.

But why would anyone prefer Optus over Telecom when it comes to Pay TV distribution? Actually, there are some very good reasons. First of all, you'd be wrong if you thought of this as just a Cable TV operation. It is hard to guess what deals are being done here, but the ownership of the Optus cable and the programming of the network seem to be inextricably linked — whereas in the PMT consortium, Telecom was to have remained the 'common carrier' with P and M providing programming.

This may have become the bone of contention. Within PMT, the programming side would have been at the long-term mercy of Telecom — both in terms of carriage costs and network roll-out timing — but with Optus, Packer and Murdoch will have a direct say in events. The Optus board agreed 'in principle' last month to the $2 billion roll-out of cable, passing 2 million homes in four years — so someone's confident!

The real money to be made from this new coaxial network is in the provision of voice-telephony — and both Murdoch and Packer will enjoy being involved in telecommunications, rather than just in Pay TV. Cable operators in the UK have found to their surprise that they can make more from telephone services than from video. This factor is likely to be very important to Optus, since Telecom charges high local call prices, and there's plenty of room for competitive undercutting. If it follows the UK model, Optus will give 25% cuts in local call costs, and, if it by-passes Telecom completely for long-distance calls we may even see true price competition in the STD market.

Optus Wins Both Ways

There are now 49 cable companies operating local phone services in the UK. According to the Independent Television Commission (ITC), cable operators in Britain have installed 377,000 telephone lines this year (to April), compared to 144,000 in 1993. Half of all cable television subscribers, when they get the choice, choose to use the coaxial cable for their local phone links, rather than BT's twisted pair. And for their long-distance calls, they usually use Mercury because of special discounts.

Translated to Australia, where does this trend leave Optus and Telecom? Potentially with Optus holding the whip hand — it has the satellites, (B2 is due to fly shortly) and it can deliver television signals to head-ends across the country very easily and cheaply, particularly to country areas.

Australia now has a proliferation of television delivery technologies in the cities and too many proposed Pay TV channels for all to survive. This strongly suggests that the video side of the city cable business is likely to be a profitless mess for many years: the profits here will come from telephony.

Optus still won't say how, where, or when it intends to roll out its coax, but it is now quite obvious that the company will be keen to get into many of the more densely populated areas ahead of Telecom. CEO Bob Mansfield said recently that he didn't foresee the company laying coax down any city streets already cabled by Telecom, but don't be too sure about this.

While Optus executives profess to be pleased with their 18% rating in the various ballots, they must be concerned about changes which will inevitably accompany deregulation. Telecom gave them some warning recently when it renegotiated the 3.14 cents a minute interconnect fee upwards by about 10%. This is just the house-warmer — the main act is yet to follow.

But they've got to be careful — a higher interconnect fee might eventually work to Optus's advantage. The carrier that gets the most value out of the interconnect fee is the company that owns the local loop, and if Optus wins the cable battle, interconnect fees will begin to pass both ways. And if they are able to offer cheap local telephony along with their cable TV connection and 20-or-so channels of news, sports and feature films, all together in a couple of attractive packages, they may be on a winner.

Optus may also be able to differentiate its Cable TV offerings by providing customers with five extra channels of good, clean free-to-air TV signals — at absolutely no additional cost.

Telecom has been unable to get rights to transmit the commercial channels on its network. The Americans have a 'must-carry' rule, but, here in Australia, the commercial channels have blocked Telecom's cable carriage by threatening to take action on the grounds of copyright infringement. They're also lobbying the Government to have the *Copyright Act* re-written to reinforce these rights of exclusion.

But with heavyweight backing would Optus cable channels have such an exclusion problem? It is hard to see that ABC and SBS, for example, would fight to prevent Australian home-owners from getting better signals. Since about 40% of Sydney homes experience poor reception, this could be an important incentive to sign up with Optus.

Telecom isn't of course, sitting idly by. Stories that it wasn't planning a true 'hybrid fibre-coaxial' system have turned out to be wrong. According to Telecom's Ross Kelso, who is now in charge of the cable project, Telecom is running a true hybrid fibre-coaxial system with a fibre distribution system, and fibre trunks down suburban streets. It is putting active splitters in manholes on street corners, and branching out with shared coaxial street feeds (0.5-inch) from these to the houses.

It will be analogue all the way, from a single head-end in each city. He points out that 64 analogue channels is probably more than enough, even allowing for video-on-demand, when digital compression can later boost channel numbers by a factor of four.

Telecom won't provide interactive paths (for games, video-on-demand and/or telephony) over the coaxial initially, except in greenfields sites. New subdivisions, however, from this year on will probably get coaxial down the street as an alternative to the old twisted-pair — so Optus will be engaged head-to-head in these locations.
Stewart Fist

Industry Development

Is it 'Time's Up' For TIDA?

Australia's Telecommunications Industry Development Authority (TIDA), set up to ensure that partial deregulation would boost the local telecommunications equipment and service industry, has been the subject of some less than kind words from unexpected sources. These include the local companies which have benefited from the carriers' industry development initiatives, and interest groups most closely associated with the drive for local industry development.

The criticism comes just as TIDA seeks to lift its profile and its horizons by conducting a survey of the wider telecoms industry in Australia, rather than simply focusing on the select group of companies that have snuggled up to the carriers. More than two years after being founded, TIDA will now seek to measure the full scope of the industry from the grassroots up, with a survey covering 1,350 small, medium and large companies. But is it too little, too late?

Executive Director of the Australian Electrical and Electronic Manufacturers' Association (AEEMA), Alex Gosman, says it is "disappointing" that TIDA has taken so long to initiate such a survey, and that TIDA has too low a profile among the smaller industry players. Executive Chairman of Jtec, John Riedl, says TIDA is not so much in search of a mission, but a soul. "The most offensive word in government circles these days is 'risk' and until people are prepared to take risks, we won't get much progress. Risk means buying from small companies, not surveying them." Others ask: how can you establish the right policy settings and maintain the momentum of growth when you don't possess hard statistics about who is doing what, and where? TIDA counters that it has been pre-occupied with monitoring and reporting on the industry development plans of the carriers.

And, to be fair, TIDA can hardly claim unlimited resources: it consists of a Secretariat of three staff within the Departments of Industry, Science and Technology, and a Board which meets several times a year. Members of the TIDA Board, which was appointed by former Senator John Button in 1992 and which is chaired by industry stalwart Bob Lansdown, include George Campbell, George Maltby, Professor Elizabeth More, Philip Singleton and Tony Staley.

At an estimated cost of $26,000, much of that going to consultants Price Waterhouse, TIDA's proposed survey will cover not only telecommunications companies but also the computer networking and video transmission sectors, in an attempt to provide statistical information on the impact of convergence. Information will be compiled on the supply of telephone sets, faxes, answering machines, engineering services and software, maintenance services, facilities management, consulting for equipment design, software development for network operation, and software for billing and management services. The survey will also study value-added services such as paging, e-mail, EDI, networking, voice services, video, teleconferencing and the activities of the service providers. It will encompass the carriers only in terms of their service provider activities.

Preliminary results are expected later this month, with a final report due by late October. Copies will be sent to participants to give them feedback and market intelligence. The report will also go to AusIndustry, the body recently set up to advise small to medium-sized companies on business and export opportunities and support schemes, and to various small business interest groups. The Broadband Services Expert Group will receive a copy, as will the committee charged with the review of the post-1997 telecommunications environment, ordered by Communications Minister Lee.

TIDA Director, Peter Moore, says: "It's true we have not had much contact so far with the plethora of smaller companies that have grown up in the telecommunications market and, statistically, there has been something of a black hole in this area. But our focus has had to be the carriers' industry development plans, and now those are bedded down, we can lift our sights to the broader environment." Moore added that the stimulation of the grassroots industry in Australia was, to a large degree, the result of the alliances local companies had formed with the multinational branches which supplied the carriers.

The survey will be carried out twice yearly until 1997. The half yearly report will be a 'pulse reading' to measure where value has been added, while the full year report will be more substantial, containing statistics on exports, R&D, capital investment and employment.

Is Networking Working?

The initiative comes at a time when TIDA has been seeking to foster more networking and clustering among those companies known in Canberra jargon as SMEs (small and medium-sized enterprises), at a series of seminars. But even these have not met with universal acclaim.

According to Alex Gosman: "I'm sceptical about government agencies organising meetings to encourage networking. Companies need bottom line results and a tangible focus, and these sorts of commercial connections are best left to the companies themselves." He added that the industry support and development schemes available in Australia were a long way from what small companies needed, largely because companies had to reach relatively high expenditure levels before they became eligible.

In fact Australia's industry development policies do appear to suffer in comparison with countries such as Israel, Singapore, Taiwan, which have stimulated their industries by established high-tech manufacturing zones with low-cost leases, and offering other incentives such as low-interest loans for plant and equipment and financial support for R&D. Israel, for example, claims to have captured 4% of the $10 billion worldwide LAN and internetworking market in five years, with export revenues expected to reach $440 million this year.

Moni Livne, MD of start-up NSW-based network products supplier INC Manufacturing, which produces Token Ring, Ethernet and AS400 products as well as distributing Retix and Chipcom products locally, believes Australia should copy the Israeli and Asian models. "In Australia, there is no real assistance for start-up industry from the Government. What new industry needs is special rates on land and special loans for manufacturing facilities. Loans should be 25 years at 5%, not five to ten years. At the moment, all our money goes into buying buildings or paying for leases, rather than into the manufacturing."

Livne added that while he had been encouraged by Austrade to attend a trade show in China in October, and was involved in P45 contracts through the Federal Department of Administrative Services, he had

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never heard of TIDA, or been offered overall advice on what government assistance or support schemes were available.

Jtec's John Riedl, whose company has thrived on the support of Telecom and government development and export assistance schemes, says agencies such as TIDA tend to make no distinction between indigenous local operations and branches of multinational companies with the word 'Australia' tagged to the end of their names. "The policies should give preference to indigenous Australian companies to ensure that intellectual property doesn't end up offshore," he said.

Similar views come from Datacraft, a 100% Australian-owned data communications company with staff of more than 600 and offices throughout Asia, which derives around 10% of its $148 million annual revenues from Telecom. The company also has OEM deals in the UK, Europe and the US. Business Development Manager, John Chamberlain, described TIDA as "not a very effective organisation which seems to be looking for a meaning in life."

But support for TIDA's role has come from JNA's MD, Peter Davies. "TIDA is effective is isolating issues and listening to industry to see how it will develop now and beyond 1997," he said. "It may not have put together any conclusions yet, but it does provide a forum for smaller companies. I don't think Australia will see the significance of TIDA for a couple of years yet."

At Telecom, the man most closely associated with TIDA is Mike Orwin, National Manager of Supply, Business Support Services in the Network and Technology Group. Orwin's view is that Telecom has always had a preference for doing business with Australian companies and this is not likely to change now or in the post-1997 environment. Pointing to the 32 commitments to local content in Telecom's industry development plan, Orwin highlighted Telecom's investment in R&D, the Export Endorsement Scheme, and its support for Australian innovation through the Product Development Fund.

So, does TIDA have a future in the post-1997 environment? The authority's Chairman, Bob Lansdown, believes it does. "The message from the industry, from companies and groups like AEEMA and the AIIA, is that they would like a continuing role for a TIDA-type organisation," he said. "After 1997, convergence will change the nature of telecommunications, with software assuming a far greater role than that of manufacturing telecommunications hardware."

He said TIDA's role was to stay in close touch with the small to medium-sized local companies to see what opportunities they could exploit as a result of convergence, and the possible entry of multiple carriers and service providers into niche areas of the Australian market beyond 1997.

Bernard Levy

New Zealand

Still No Clear Path to Competition

Clear Communications continues to make competitive headway in New Zealand — albeit slowly. The company's share of the tolls market is now almost 20% — including 19% national tolls and 23.5% international. However, it has only managed to wrest 7% of the total market share from Telecom Corporation of New Zealand (TCNZ) and is still the latter's only serious competitor. Others account for a mere 1% of the market with TCNZ hanging onto 92% of the $NZ2.8 billion total. Roughly the same share, incidentally, that AT&T held when it was broken-up in 1984.

Clear CEO, Andrew Makin, commented on the state of competition in the marketplace in his speech at last month's annual TUANZ Conference.

Clear and other competitors, notably BellSouth which competes in cellular, are highly critical of the New Zealand's deregulation model, which effectively replaces a formal regulator with court action. Deregulation has come, in practice, to rely on section 36 of the *Commerce Act* which forbids use of a dominant position on the marketplace for anti-competitive purposes. However, there are no punitive penalties, said Makin, which restricts its effectiveness. He also pointed to a recent significant court ruling against the Commerce Commission involving the latter's right to investigate telecommunications in an action brought by TCNZ. The Commission was "dismissed by the courts not because it was wrong, but because it was found the commission doesn't have the jurisdiction to undertake such an investigation," he said.

At the time of writing, Clear was awaiting a crucial decision from the Privy Council in London, New Zealand's highest court of appeal, which will affect its entry into local services — a market it has been trying to enter for three years. The decision affects the interconnect terms and the case resulted from an appeal by TCNZ against the New Zealand Court of Appeal's ruling that it had restrained competition in respect of Clear.

Despite the limits on competition, Makin concurred with an earlier TUANZ view that what was required was not so much formal regulation, but the putting in place of "certain ground rules."

Interestingly, the present ground rules themselves may be changing. Clear not only continues to make slow progress in developing its own alternative network, but in doing so appears to have reached something of a new accommodation with its rival. Clear is presently laying a second fibre-optic cable down the east coast of the North Island, a $NZ40 million investment that TCNZ is also involved in. Participation is tacit admission that TCNZ now accepts Clear's presence as permanent.

Clear is also upgrading its network capability with a move into virtual private networks with its BSN (Business Services Network). Perhaps not surprisingly in view of this and other new services — including a new Windows-based service allowing customers to analyse bills delivered on disk — Clear won the 1994 TUANZ award for 'Most Responsive Company.' The award is voted on by users in 330 companies.

The competition issue has also taken on an international aspect that Makin made much of in his TUANZ speech, underlining how 'local' Clear is, having an overseas (North American) investment of just 43% — a cutting reference to TCNZ's higher overseas investment component. He said all Clear's profits were being ploughed into extending its network — $NZ37 million in the last year out of a current total of $NZ207 million in fixed assets.

His comments come in the wake of criticism over TCNZ remitting 90% of its 1993-94 $NZ528.1 million profit to shareholders in dividends. $NZ474 million was paid out to shareholders, with 80% of those shareholders being in the US, although TCNZ's major investors, Bell Atlantic and Ameritech, hold only 49.9%, not being allowed to own any more.

TCNZ spokesman Clive Litt said he was at a loss to explain why more New Zealanders had not invested in TCNZ when the opportunity was there, with 50.1% of the shares being traded on the open market. Although 30,000 New Zealanders hold shares they are in small packets. He added that not only was Clear a private company, so no public share investment was possible, but minority Clear investor, NZ Rail, was now a US-owned company. The latter holds 15% shareholding in Clear. (Other overseas investors, Bell Canada and MCI, hold 21.25% of Clear, respectively). This means the North American investment component in Clear is rather higher than 43%, albeit indirect. NZ Rail is still a New Zealand listed company, however.

Perhaps tariffs are the best measure of New Zealand's unique market. A recent survey by the International Telecommunications Users Group (INTUG) covering 25 countries found both New Zealand and Australian tariffs to be above average for advanced economies. New Zealand ranked 20th for the 'five-minute call basket.'

Bill Bennett

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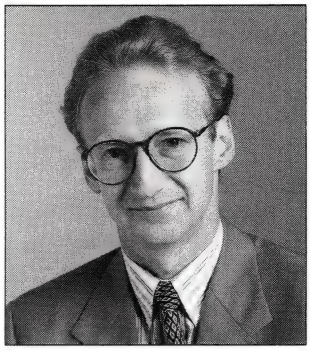

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The SPA Fallout

Service Providers Bemoan Disruption

Despite bending over backwards to make its former Strategic Partnership Arrangement (SPA) customers offers they can't refuse, and despite lodging new service provider tariffs with Austel, Telecom remains under pressure from the bigger resellers. They claim the dropping of the old fixed-term, volume-based discount plans has caused disruption to their businesses, and some are demanding termination payments.

Chief among the critics have been AAP Telecommunications, Pacific Star Communications and BT Australasia. While conceding Telecom has been 'very reasonable' in offering a range of new, unbundled, replacement tariffs, they claim the dropping of the SPAs caused uncertainty and forced them to renegotiate arrangements with their own customers.

Estimated to generate a total of between $300-$350 million in annual revenues to Telecom — not far behind the Federal Government's estimated yearly outlay of $350-$400 million on telecommunications services — the Big Four service providers, including Axicorp, have now accepted, or are negotiating, individual pricing plans lasting for a maximum 12 months for the unbundled Telecom services. Telecom's old high-growth SPA 1.02, which bundled local, long distance and data services together on a volume basis, lasted for up to five years. Some SPAs, including the low-growth SPA 1.01, had up to three and half years to run when they were scrapped on June 30.

But according to AAP Telecommunications' Director of Regulatory Affairs and Chairman of the Service Providers Action Network (SPAN), Brian Perkins, while Telecom had accepted it must come to some form of financial agreement with its 51 ex-SPA customers, AAPT was not likely to save money from the new arrangements. "Our arithmetic suggests that maybe we will not get the discounts we had with the SPA," he said. "I think Telecom understands that money needs to be involved and they appear have been very reasonable in dealing with anyone who felt the new pricing plans would disadvantage them."

Both Telecom and Optus have made presentations to SPAN, whose members total around 140. On top of the unbundled replacement tariffs, Telecom has submitted to Austel a new service provider range called Charter, a five-level, STD and IDD voice product covering customers spending between $800,000 and $15 million per year.

Telecom's discussions with Austel, and its negotiations with resellers including international groups such as Saturn and Singcom, from Singapore, have been headed by John Losco, National General Manager of Service Providers. Since June 30, Losco has mobilised 28 account executives into smaller teams to negotiate with Pacific Star in Brisbane, Axicorp in Melbourne, AAPT and BTA in Sydney, as well as the major corporate SPA customers around the country.

Michael Begun, Managing Director of Telecom's biggest single service provider customer, Pacific Star, said the dropping of the SPAs had been the subject of "serious" discussions between the two organisations. As a facilities manager, Pacific Star earns revenue from the differential between the aggregated $100-odd million total size of the Queensland Government telecommunications bill, and any savings it can negotiate with suppliers. Such savings had been secured by its centralised billing subsidiary, SunNET, which had negotiated a $250 million SPA with Telecom.

"The dropping of the SPAs was a disruption in what had previously been an orderly market," Begun said. "Telecom did what it had to do for legal reasons and I hope we now see a series of special tariffs for service providers. The original intent of the SPAs was to allow Telecom to share cost savings with the large customers in the form of planning, bill consolidation, etc. Pacific Star performs a great number of services such as billing, attending to faults and end-user marketing, and this can be a source of true savings to the carriers' cost structures. We would like to see tariffs that reflect those savings, in that we provide value to both ends — the carrier and the customer."

Begun said this argument formed part of Pacific Star's submission to Austel, which is in the process of establishing a Decision Making Framework (DMF) for assessing basic carrier tariffs, and of producing final recommendations on the future of resale in Australia by the end of the year.

Begun said that while Pacific Star, as the manager of the Queensland Government's network, remained Telecom's largest single customer, his company had also been dealing with Optus and would continue to make commercial decisions based on how competitive the two carriers were.

Commtel: The Biggest Prize

Apart from recently signing a $30 million deal with the Local Government Associations of Victoria, NSW and Queensland to manage the communications systems of 500 local councils, Begun said Pacific Star was also talking with the Federal Government's central communications coordinating agency, Commtel, about managing billing for the many departments whose telecommunications budgets were being aggregated under 'whole of government' purchasing plans. While each department retains the right to negotiate individually with carriers and service providers, Com-

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mtel has a charter to facilitate savings and greater competition by bargaining collectively on the Government's behalf.

Commtel's Assistant General Manager, Baldev Bedi, said that while the SPAs had offered significant discounts, his agency was attempting to balance the need for the most cost effective pricing plans with the Government's push to use its purchasing power to encourage more competition in the telecommunications marketplace.

He said that as a result of this policy, Commtel did not intend to commit all its business to Telecom and was now talking with Optus, Vodac, AAPT, Pacific Star and others. "I estimate we will save around $100 million over five years by taking advantage of the competitive environment," Bedi said.

From the beginning of last month, agencies involved in whole of government pricing plans included Social Security; Employment, Education and Training; the Taxation Office; Human Services and Health; Defence; and the Bureau of Meteorology. Negotiations were going on for another 10, including the Bureau of Statistics; Attorney General's; Administrative Services; Finance; Foreign Affairs and Trade; Treasury; Industry, Science and Technology; and Industrial Relations. More departments will be brought in under Stages 3 and 4 of the Commtel program.

General Manager of Value Added Services at Axicorp, George Caravias, said Telecom now understood better the needs of service providers and its new plans reflected this. "The plans we have now allow us to operate as service providers every bit as much as before the SPAs were dropped on June 30. The new plans take into account the commitments that all big service providers have to undertake, such as billing and providing help desks and technical support. Once we've worked through all the issues with Telecom, we should be able to operate even more effectively."

He said that while Optus had pressed for an end to the SPAs, the second carrier might regard some of Telecom's new tariffs with concern. "Optus and the service providers now have the chance to find new ways of delivering services and solutions. But Telecom is not shrugging away from the challenge and they realise they have a new industry emerging under their noses. Telecom sees there will be lots of ways to work with new players and service providers to their own benefit and the benefit of the customers."

Caravias said Optus was working hard to establish its own service provider network and, in an environment where "everyone is talking with everyone," the second carrier was sounding out AAPT, Axicorp, Equal Access in Melbourne and as many as 30 other smaller companies.

Senior Commercial Manager with BT Australasia, Geoff Cornish, said it was impossible to erase the disruption caused by the dropping of the SPAs. "Telecom is the prime supplier of a product you cannot get from anywhere else. So when they change, it affects the whole industry," he said.

Bernard Levy

Globalisation

BTA Joins in the Concert

The much-trumpeted launch of the joint British Telecom/MCI global telecommunications company, Concert, will have very little real impact on the revenues of BT's local arm, BT Australasia (BTA). In fact, the Sydney-based operation, with current annual revenues of around $20 million, will be paid a straight service fee for selling Concert products and connecting multinational companies in the Asia-Pacific region. BT Australia will also provide on-going maintenance and customer support services. But the income generated by Concert call traffic will go directly back to BT's headquarters in the UK.

With annual revenues of around $30 billion, the British giant will offer Concert products to all parts of the world other than the North America/Latin America markets, which will be covered by MCI, America's second-largest long distance provider with annual revenues of $US12 billion. Formed from BT's $US4.3 billion purchase of 20% of MCI, Concert is being hailed as the 'first company to provide a single source, broad portfolio of global communications for multinational customers.'

The main selling point for Concert's Global Virtual Network Services, Managed Data Services, Customer Management Services and Global Application Services, is that customers will no longer need to negotiate with a myriad of different national and international networks and carriers.

But the new enterprise, which will absorb BT's Syncordia global outsourcing operations, is not about to take the world by storm. Concert products and services will remain under trial until at least the end of the year among 20 of BT and MCI's major Global Network Service (GNS) and Global LAN Interconnect (GLI) customers, including British Petroleum, Glaxo, First Data Corporation and Holiday Inn. The aim is that from next April, Concert will gradually link more than 5,000 business customer access points in 55 countries through Global Customer Support Centres in Paris, London, Sydney, Tokyo, and North Carolina.

BT and MCI have committed to spend $1 billion to develop Concert over five years and will act as the selling agents. But they remain free to pursue business prospects in their own right.

In Australia, BTA will continue to build and manage the voice and data network for the NSW Government, while MCI will carry on selling its direct calling services to the US. BTA staff in Australia and New Zealand will go on servicing the GNS needs of customers such as the Commonwealth Bank, BHP, Thorn EMI and the New Zealand Ministry for External Relations and Trade which have offices around the world. But when new Concert customers are signed up in the Asia-Pacific, they will be looked after by the 100-odd BTA staff who man the BTA Network Management Centre, and the high-security building which houses the international node in Sydney.

In terms of revenue growth, BTA's Managing Director, Peter Hutton, said he expected the biggest boost to come from the NSW Government private network and other services provided to the Government outside of that contract. The NSW Government network will ultimately connect 150 government agencies at 5,000 sites around the State, involving 120,000 telephones and 60,000 personal computers. Designed to carry the bulk of the NSW Government's estimated $150-$200 million annual telecommunications traffic, the network should be fully operational by the second half of next year, impacting significantly on BTA's 1995-96 financial results and lifting the company towards a break-even point a couple of years later.

Hutton said the creation of Concert and the existence of the Sydney node meant that BTA could ultimately offer Concert-type services to the NSW Government or large corporate customers. "For example, we could take calls from BHP, run them over the NSW Government network, either within Australia or take them out to one of our international networks," he said.

As for Concert rivals, such as the AT&T-Singapore Telecom-KDD-Telstra group, WorldPartners, the Sprint-France Telecom-Deutsche Bundespost Telekom consortium, Atlas, and the Holland-Sweden-Switzerland cluster, Unisource, Hutton said: "Demand for one-stop, high-end global network services will grow rapidly, as will the competition. With Concert, British Telecom is about a year ahead of the others at this stage, but that window of opportunity won't last forever. We expect competition from the others in different segments of the market. In some areas, AT&T and WorldPartners will be the biggest competitor; in others, it will come from Sprint and the French and Germans. We just don't know yet, but we'll be ready."

Bernard Levy

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Assessing ATM for Enterprise Nets

According to tests by the French LARA project, ATM enthusiasts face at least a year's delay before deploying the technology on large networks.

Corporations worldwide need to decide when and how to move their networks to ATM. But it's too bad they have little or nothing in the way of hard facts to help them come up with successful strategies.

The French LARA (L'expérimentation Aristote de Réseau ATM) project was created to furnish the requisite information. Grouping together eight major corporations and research institutions running large computer networks, this initiative set out to see how close state-of-the-art ATM (asynchronous transfer mode) technology came to meeting the high-speed networking requirements of project participants. To do this an ATM test bed was built that put 30 products from 16 vendors through their paces.

After two months of testing — from November 1993 to January 1994 — the verdict came in. Large corporations will have to wait at least another year before they start introducing ATM technology onto their networks. And it will be another five years before they can begin pumping 53-byte cells end-to-end across their electronic arteries.

Why the delay? It will take at least that long for long-distance or international ATM connections to become available. Key components of ATM standards are yet to be defined, and a critical ATM switch-signalling specification passed by the ATM Forum in November last year has run head-on into an incompatible standard from the ITU's Telecommunication Standardisaton Sector (ITU-T), the international carrier standards organisation.

There is simply no standard way for current applications to take advantage of ATM's capabilities. ATM switches ran into problems shunting bursty 100Mbps local traffic onto E3 (34Mbps) WAN links. And today's LAN protocols like TCP/IP and IPX cannot take advantage of the bandwidth offered by ATM.

Net managers in a hurry have only one viable option: install single-vendor solutions based on native ATM links between workstations and switches. That means relying on more or less proprietary software to get the job done. For everyone else, it's sit tight and watch developments on two fronts. First off, how quickly can the ATM standards bodies get their acts together? Second, what can be done to remodel legacy protocols such as TCP/IP and IPX and bring them up to pace for high-speed cell switching?

Starting with the Basics

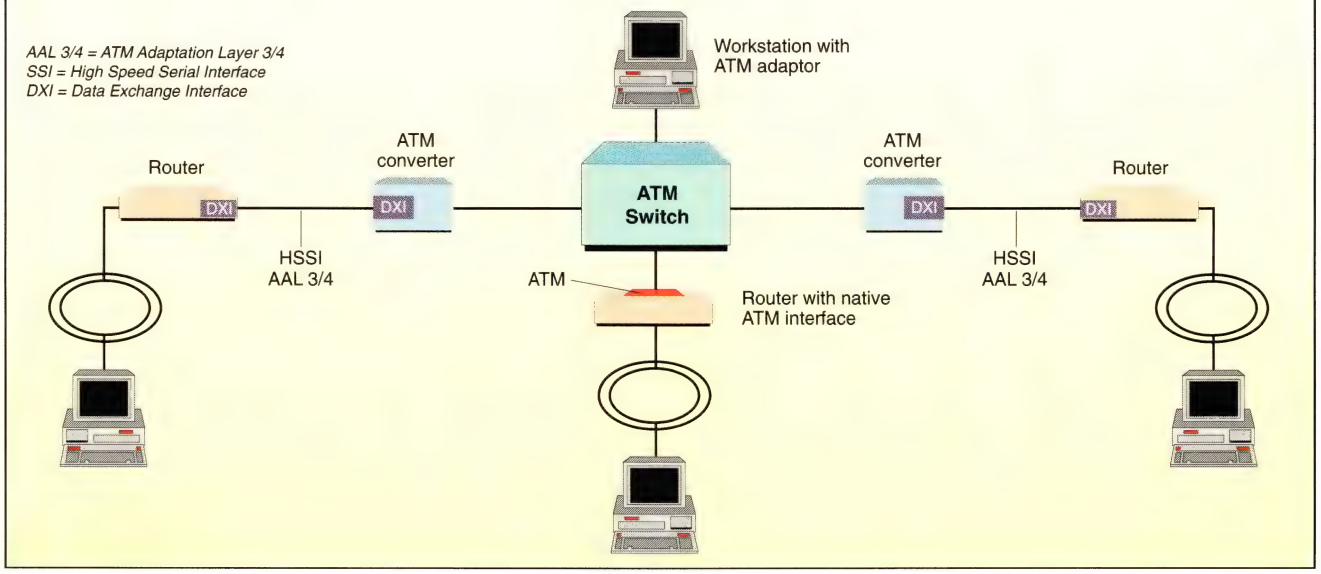
The first phase of the LARA project set out to study the basics of ATM:

- How do cell switching devices physically connect?
- What levels of throughput do ATM adaptors and switches really support?
- What are the consequences of using native ATM, frame relay, or SMDS (the US Switched Multimegabit Data Services) to transmit ATM cells over the wide area?
- What guarantees of interoperability are offered by cards and switches from different vendors?
- How do legacy data transmission protocols work over ATM?

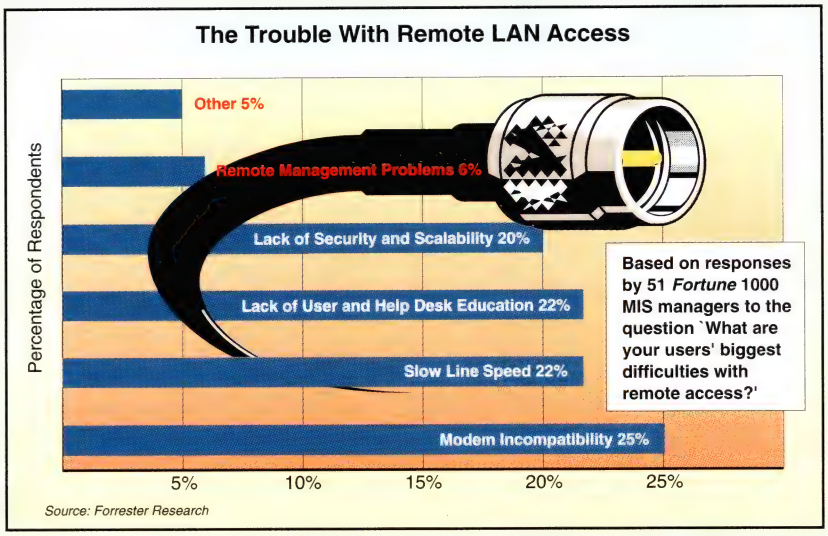
To find the answers to these questions, two test beds were set up at the Clamart research centre of the EDF (Électricité de France), the French national power authority: a local test bed using routers to connect FDDI LANs to a simulated ATM WAN (see Figure 1); and a wide area test bed packed with a mix of ATM workstations, switches, routers, hubs, and analysers (see Figure 2 on page 27). The wide area test bed was used to shunt traffic over 34Mbps leased lines.

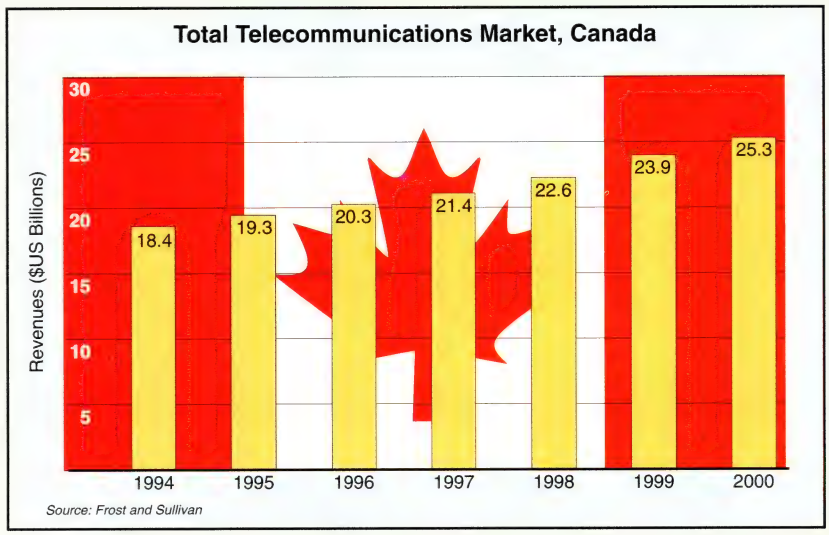
Figure 1: ATM For Native and Non-Native Speakers

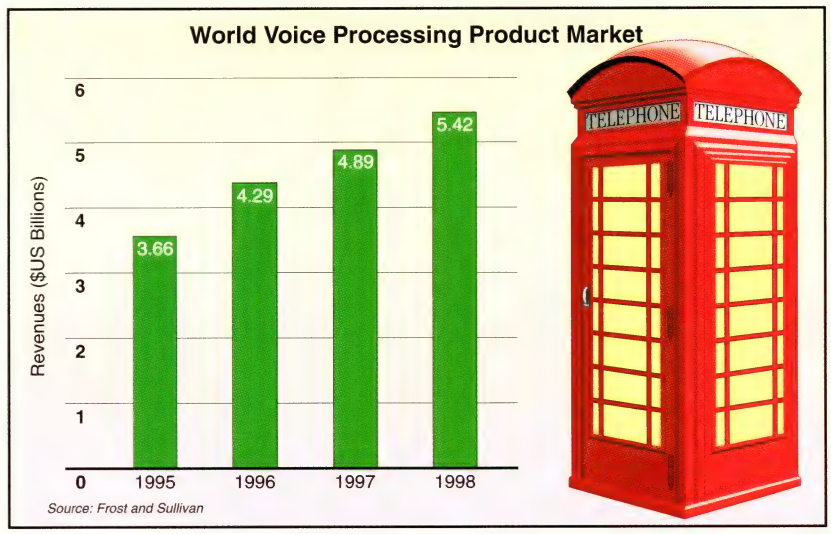
LAN traffic must be converted into 53-byte cells before it can be handled by an ATM switch. This can be done with an external ATM converter (such as a US-style CSU/DSU) or via a native ATM interface. Tests reveal that while routers with external ATM adaptors can communicate with each other, they cannot exchange information with devices fitted with native ATM interfaces. The reverse also held true: devices with native ATM interfaces could only talk to one another. Thus, the workstation linked to a router with a native ATM interface can reach the workstation equipped with a native ATM adaptor but cannot reach the stations connected via an external ATM converter.



Market Watch







But before they were able to get all the different ATM gear to work together, the project leaders had to contend with interoperability issues on three levels. First, different devices had to be physically connected. Second, data from various applications had to be diced and sliced into 53-byte cells. Finally, IP datagrams had to be encapsulated so they could pass through the test network. Getting all of this accomplished might not have been such a big deal if there weren't so many options available to the testers.

Plug and Play?

Merely establishing physical connectivity can be a chore. Partisan politics on the part of both LAN and telecom vendors have left prospective ATM enthusiasts with a bewildering array of interfaces to contend with. Worse, US and European standards don't match up.

At the low end, Europeans naturally have opted for the E3 WAN interface. In the past, E3 has been bogged down with several incompatible versions, but recently ETSI (European Telecommunications Standards Institute) has given its full support to the G.804+G.832 specification.

The low-end North American DS-3 interface delivers 45Mbps; higher rates are now available through Sonet (Synchronous Optical Network). Sonet-OC1 runs at 51-Mbps; Sonet-OC3 runs at 51Mbps; Sonet-OC3 hits 155Mbps; Sonet-OC12 peaks at 622Mbps. High speeds also are offered by a pair of European SDH (Synchronous Digital Hierarchy, which has been adopted for Australia) interfaces. SDH-STM1 runs at 155Mbps; SDH-STM4, at 622Mbps. Unfortunately, they are only partially compatible with Sonet.

LANs also have given rise to two interfaces. The first, TAXI (Transparent Asynchronous Transmitter/receiver Interface), takes advantage of common FDDI components and runs at 100Mbps using ST, SC, or MIC connectors. The second is derived from fibre channel technology and tops out at 155Mbps using 8B10B encoding.

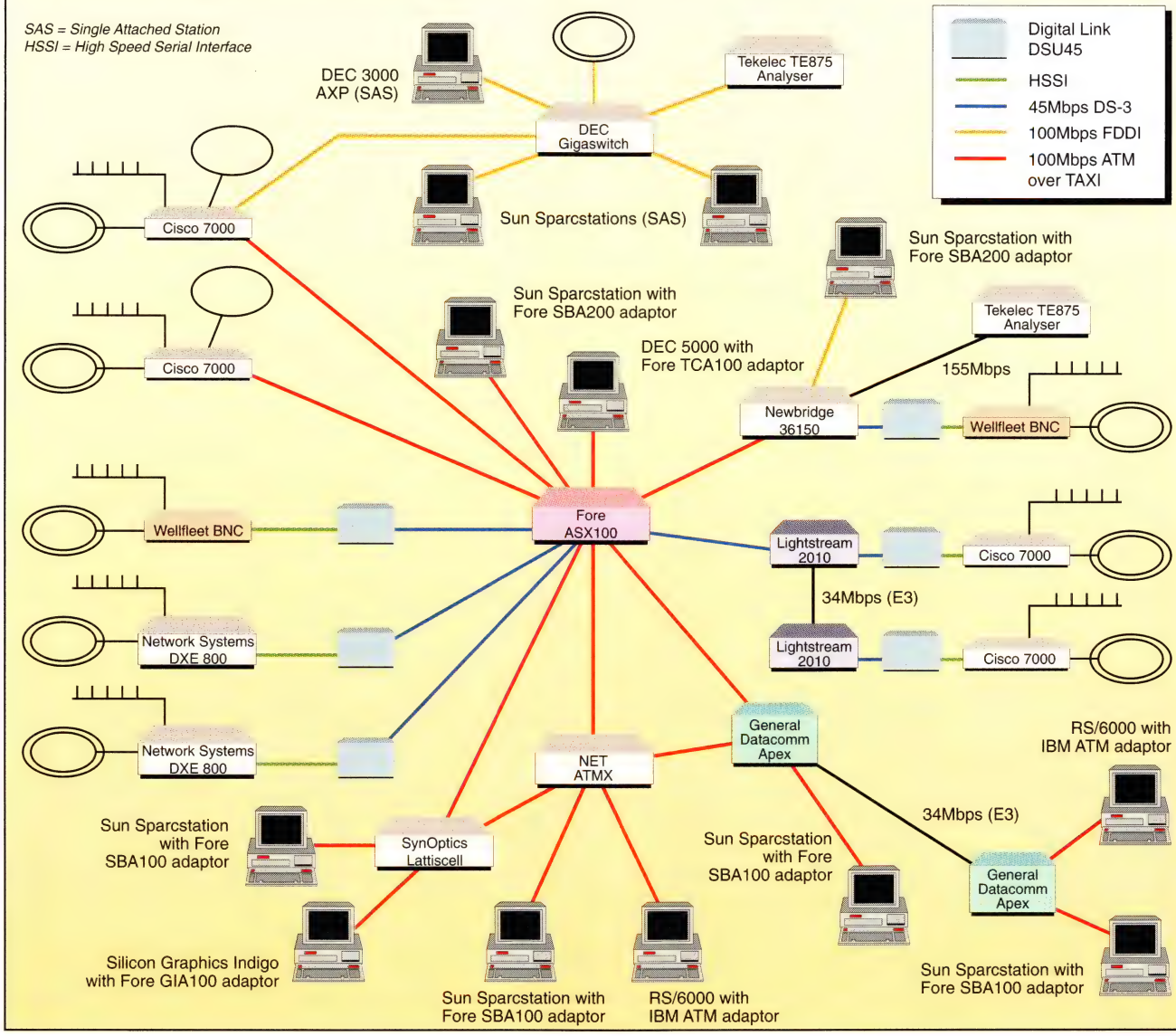
The LARA test bed experimented with two versions of E3, as well as DS-3, TAXI, Sonet, and SDH-STM1. Obviously, devices not sharing the same physical interfaces could not be directly linked.

Celling the Frame

Once the ATM devices on the test bed were physically connected, the project leaders went on to the next hurdle: the ATM adaptation layer (AAL). The purpose of this layer is to allow voice, video, and data traffic to be accommodated successfully by ATM. This is more complicated than just chopping frames into 53-byte cells. Cells propagated across an ATM network are subject to random delays, which can play havoc with time-sensitive voice and video applica-

Figure 2: Project LARA's ATM Testbed

To assess ATM interoperability and gauge how well the technology can deliver on its promise of 100Mbps throughput, the LARA project loaded its test bed with 30 ATM switches, routers, hubs, workstations and adaptors from more than 16 vendors. The evaluation also took a look at how well ATM can handle conventional LAN protocols.



tions. And cells carrying data must be protected against bit errors before ATM can make good on its claim to be a reliable transport mechanism.

These requirements have given rise to a variety of standards — most of which are not yet final. Since the LARA project was chiefly concerned with data transmission, it focused on two standards: AAL 3/4 and AAL 5. The former is the handiwork of the ITU and makes it possible to multiplex several AAL connections onto one ATM channel. The latter, promoted by the ATM Forum, has been stripped down to essentials to lessen the load on ATM machines running at breakneck speeds. The same caveat that applies to physical interfaces goes for AALs: only products that conform to the same standard have any chance of communicating with one another.

The IP Angle

Once the LARA project leaders had the physical interfaces and AALs sorted out, they still had to contend with moving IP datagrams over ATM. Here, RFC 1483 from the IETF (Internet Engineering Task Force) came into play. This RFC (Request For Comment) describes two methods for routing or bridging IP datagrams. The first technique, LLC (Logical Link Control) encapsulation, allows different protocols to be multiplexed over the same ATM virtual circuit. This technique adds a 2-byte PID (protocol identifier) field to the IP datagram header to indicate whether the networks being linked are Ethernet, Token Ring, or FDDI.

The second method, known as null encapsulation, is still in the works. It sets up separate virtual circuits for every protocol moving through the network.

RFC 1483, however, is only a starting point for coping with IP and IPX, which were designed for the shared-media LANs rather than ATM's switched technology.

To really make IP 'all systems go' on ATM nets, standards bodies will have to work out ways to cope with broadcasts and multicasts. IP addressing has to be adapted to the ATM transmission mechanism, which employs virtual paths and virtual circuits to direct cells from one point to another.

Once the triple task of connecting interfaces, adapting data packets to cells, and encapsulating IP datagrams was wrapped up, work could proceed on the test bed. The project leaders had already determined what combinations of devices would actually play together and found that as long as all restric-

tions were met the network would respond properly. Because the first phase of the LARA project has set its sights on sending TCP/IP over ATM, the majority of devices had 100Mbps ATM interfaces and used the AAL5. Both methods of IP encapsulation described in RFC 1483 were employed.

The next big step for the LARA team was to build a full-fledged ATM network.

Testing Two-Step

Two configurations were tested. The first was an all-ATM setup with cell switches moving traffic between native ATM workstations. The second linked together ATM, Ethernet, and FDDI devices.

When all the switches on the pure ATM test bed were from the same vendor, they were capable of configuring virtual circuits on the fly. When switches from different vendors were strung together, however, switching tables had to be configured manually to match the virtual paths and circuits on the incoming ports to their counterparts on the outgoing ports before traffic could flow. In addition, the IP address of each workstation had to be manually matched with a virtual path and circuit. This sort of manual configuration quickly proves to be an impossible task on a production LAN.

It should be noted that at the time of the evaluation none of the devices on the test bed had implemented the Q.93B Switched Virtual Circuit access signalling protocol. Originally proposed by the ITU, the protocol has been since reworked by the ATM Forum and become part of the User Network Interface (UNI) 3.0, completed in November 1993. Based on a subset of ITU's broadband signalling standard, the protocol establishes point-to-point connections dynamically once a user's request to set up a link has been accepted. Both the ATM Forum and ITU are now reworking the original signalling access protocol. The ITU has come up with Q.2931; the ATM Forum is redesigning its UNI 3.0 to take into account the ITU's most recent spec. This move toward a common signalling system marks a significant step towards ATM interoperability.

The Local Look

The LARA group's local test bed used routers to connect FDDI LANs to a simulated ATM WAN. While some of the routers relied on external ATM adaptors, others came equipped with native ATM interfaces. The latter encapsulated LAN frames according to RFC 1483 before transmitting them. Tests showed that workstations connected to this type of router can communicate with any of the stations and routers on the network also equipped with native ATM interfaces. This was not true for routers that use external adaptors to convert frames into ATM cells. Indeed, none of the stations sitting on the legacy LANs linked to routers using black box adaptors could communicate with any of the devices with native ATM interfaces.

The LARA test team soon discovered the guilty party. The standard DXI (Data Exchange Interface) coupling the routers on the test bed to external ATM adaptors requires either US style SMDS or frame relay to pass data over the HSSI (high-speed serial interface) link between the router and the ATM CSU/DSU. Stations and routers with native ATM interfaces could simply not decode this extra protocol layer. Thus, an ATM workstation could talk to a workstation that is connected via FDDI to a router with a native ATM interface. But workstations connected to routers with external ATM interfaces could not communicate with these stations. The lesson is clear: net planners who want true any-to-any connectivity over ATM should at all costs avoid routers that are not equipped with native ATM interfaces.

Setting the Pace

The LARA test team chose to measure ATM throughput on three different connections: local back-to-back links between native ATM workstations, local links running through ATM switches, and wide-area links running over 34Mbps WAN links.

The back-to-back tests brought the rapid evolution of ATM technology to light. Two generations of interface cards were put to the test: early adaptors relying on software to carry out the tasks of segmentation and reassemble, and newer cards designed to execute these functions in hardware. TCP/IP UDP (user datagram protocol) frames were sent between machines.

Tests showed that throughput over a 100Mbps TAXI link between two Unix workstations running UDP jumped from 40Mbps to 80Mbps when the newer cards were used. Analysers confirmed that no data was being lost on the ATM level itself; the 20% data loss (20Mbps) was traced to the time needed by the Unix workstations to process the application, transport, and network protocol layers. Tests now ongoing using higher-performance workstations are showing near wire-speed throughput. These new tests confirm the underlying ability of ATM to deliver data media rates.

The LARA test team had far less luck when switches and WAN links were added to the picture.

Bursting the Buffers

The first problem appeared when bursty data streams were sent from a 100Mbps TAXI interface to ATM switches equipped with 34 and 45Mbps WAN interfaces. In these cases, the team observed a complete breakdown of data transmission as loads on the test bed increased. In fact, the loss of a single cell per datagram was often all it took to grind traffic to a halt.

The problems seemed to centre around the switches' inability to buffer bursty high-speed traffic, which resulted in corrupted datagrams and dropped cells.

The ITU is currently working on two techniques to help with this problem. Traffic shaping will allow workstations to alleviate the pressure they put on switches by letting them space out the cells they send on-line. Policing gives switches a way to check that stations are not exceeding their negotiated throughput rates. The ATM Forum also is looking into congestion control to help alleviate cell loss. One of its schemes is credit-based; the other uses back pressure on the sending ports to tell the workstation to throttle back. It will take some time for these two organisations to settle on a common approach.

The second problem with the ATM wide area network connections involved TCP/IP, which performed poorly over the E3 links. Analysis showed these slowdowns were a result of the propagation delays encountered by TCP/IP acknowledgment frames.

TCP/IP sends traffic in sliding windows up to 64 bytes long. A source has to wait until it receives an acknowledgment from the address to which it has transmitted before sending further frames. But lengthy propagation delays will stretch the time it takes an acknowledgment to make it back to the source. In the most favourable case, with traffic being pumped through optical fibre at the speed of light (300,000km/h), the round-trip travel time needed to cover 2,000kms is 0.006 seconds. A 155Mbps interface, however, only needs 0.003 seconds to transmit one 48Kbyte window. The TCP/IP transmitter thus will be idle one-half of the time. Over the wide area TCP/IP can thereby cause transmitting stations to remain idle for extended periods, thus robbing ATM of a significant portion of its available bandwidth.

The inadequacy of popular protocols for ATM extends to IPX, the standard for routing on Novell NetWare LANs. IPX loads the network with different kinds of service frames, generally timed to be broadcast every 60 seconds. Passing almost unnoticed on Ethernet and Token Ring LANs, SAP (Service Advertising Protocol) packets are already known to be costly passengers on the wide area and will be even more of a problem over ATM. By flooding a large number of virtual circuits, these service frames can put a stranglehold on ATM switches.

Novell is now starting to work on connection-oriented IPX that, in conjunction with NLSP (NetWare Link Services Protocol), promises to let applications access reserved lanes for their data and to hold down SAP packets.

The LARA team also discovered that only one of the ATM workstations tested had implemented bandwidth reservation. The station's throughput, which was man-

Continued on page 38

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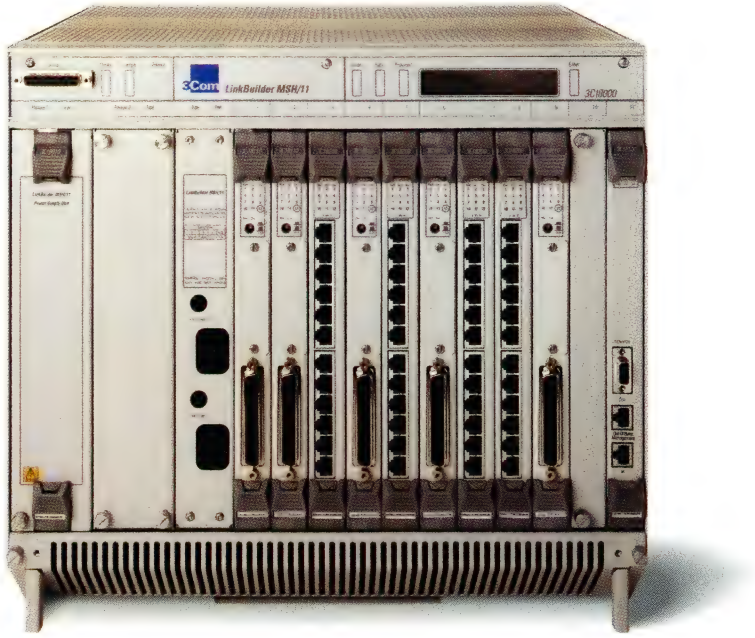

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Voice and Data Networking

Bringing the PABX into the Corporate Network

Data through the PABX, it's an idea with a familiar ring to it. Familiar at least to those who follow PABX supplier promotions because this was one of the features trumpeted during the 1980s when second and then third generation PABXs were launched.

Promoted with such catchcries as 'transmit voice and data through a single cable,' transmitting data through the PABX was an application vigorously touted by the suppliers, yet — with a few isolated exceptions — one soundly rejected by the market.

The promotion of data through the PABX was never all that serious. The suppliers targeted the mythical organisation in which employees would each have been provided with an expensive digital handset. By adding a V.24 port to each such handset, these staff could each be afforded occasional access to each of the company's many standalone and incompatible computer systems.

What this promotional material failed to mention was the large number of digital phones or 1 or 2-port interface modules required to interface the PABX to the computers. What was needed was a multiplexed PABX-to-host computer interface and, just as the PABX suppliers cannot agree on a common inter-PABX signalling protocol, they couldn't agree on such an interface.

And without one, data through the PABX was never a goer. The market as a whole didn't buy it, and gradually the suppliers stopped announcing it although data modules continued to be available.

But just as most communications analysts and managers may have forgotten about shifting anything but voice through a PABX, there are moves from at least a few PABX vendors to offer LAN integration, ATM and multimedia support and even non-proprietary network management.

No Standard Approach

One argument for combining voice and data into the PABX, that of simplified cabling and reduced maintenance and cabling costs, is once again being promoted. It's an argument that is well timed as an increasing number of organisations are now moving towards having a PC or VDU on every desk and many communicationss managers are faced with the prospect of replacing proprietary coax or other cabling with new cabling systems.

On the other side of the coin, though, on-site data communications is increasingly standardising on Ethernet using unshielded twisted pair cabling and an increasing number of components are available for this cabling system.

Nevertheless, the problem of providing a multiplexed interface between the PABX and the host computers remains. In the mid-1980s, there were three attempts to produce just such an interface: CPI from Northern Telecom and DEC, DMI from AT&T and ECMA 102 from ECMA (European Computer Manufacturers Association). However, with three standards and few customers wanting them, few computer suppliers implemented any of them and the idea gradually faded away.

Sunk by the LAN

If anything sank the idea of using the PABX as the organisation's central communications hub for both voice and data, though, it was the emergence of the LAN as a ubiquitous means of providing communications between VDUs and host computers and between PCs, host computers and a multitude of servers.

Whereas the PABX was a centralised and relatively inflexible system offering switching between pairs of fixed bandwidth circuits, LANs were decentralised flexible fully

A Sampling of PABX Features

	ALCATEL	FUJITSU	NORTEL
PABX	4300M, 4300S	9600L	Meridian SL-1
DATA COMMUNICATIONS SUPPORT			
Data Interfaces on SIHs and Data Modules	V.24, V.35, X.21, RS422/proprietary	V.24, X.21	V.24, V.35
Integral X.25 PAD	No	No comment	No
Integral LAN interface	Under development	No	No
CONFIGURATION MANAGEMENT			
Menu-driven customer administration terminal	Yes	Yes	Yes, using Switchview product
Capability to accept bulk changes	Yes	No	Yes, using Switchview
Capability to prepare a new configuration off-line, install it, test, it and reinstall previous configuration	Yes	Yes	Yes, using Switchview
Capability to do the above for more than one PABX at once using a single facility	No	No	Yes, using Switchview
NETWORK MANAGEMENT			
NM using CMIP or SNMP protocols	Under development	No, but Management Agent for PABX under investigation	No, claimed higher functionality with proprietary interfaces
Menu-driven NM facility with a graphic display	Menu-driven, but without graphics	No	Yes, using Switchview
NMS able to be simultaneously connected to more than 1 PABX?	No	No	Yes, using Switchview
Can more than one user simultaneously access a single PABX and make changes using one or more of these NM facilities?	No	Yes	Yes, with Switchview
Remote monitoring of signal leads	No	No	No

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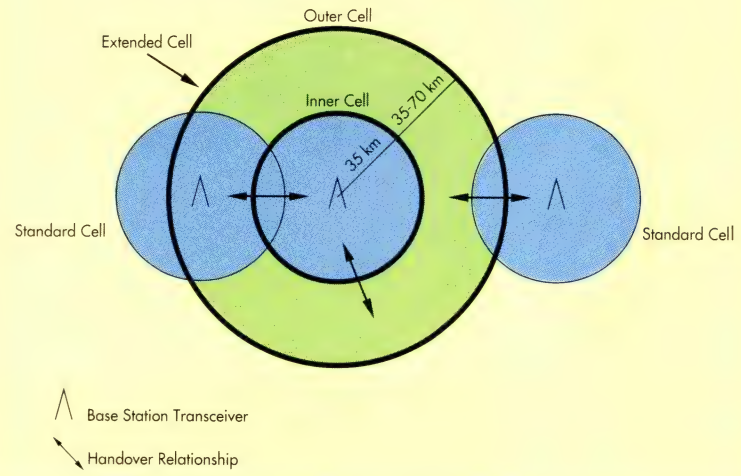
Alcatel's Extended Cell Configuration



Alcatel Australia Trials New GSM Technology

Engineers from Alcatel Australia, working in close association with Telecom, have trialled the world's first GSM mobile services using a new 'extended cell' technology. The technology allows an existing base station to double the radius of its current radio coverage, resulting in significantly reduced network infrastructure costs and faster system rollout.

Under existing GSM standards there is a distance limit of 35km between the base station and the phone set, requiring base stations to be located at least every 70km if continuous coverage is to be maintained. This can pose a problem in environments like Australia, where very large capital expenditure is required to service areas with relatively few subscribers.

To solve this problem, engineers from both organisations developed a new method by which Alcatel radio base stations can be reconfigured so that they each provide two radii of coverage — one from 0-35km, and the second from 35-70km. The base stations also have the ability to compensate for the signal delays associated with telephones operating from between 35km to 70km from the station.

The new technology was initially tested at Alcatel's Alexandria R&D facility in Sydney, and field trials were later undertaken in Toowoomba and Cairns, in Queensland.

integrated communication systems employing packet switching technology. LANs have the added advantage of being more suited to evolutionary growth to match that of the department or organisation.

The traditional approach to integrate LANs, indeed any data communications within a PABX, has been to use circuit switched 64Kbps channels, an approach most PABX suppliers still use today. However, this has a number of limitations. One is that the interfaces available on a PABX's system integral handsets (SIHs) and data modules are synchronous or asynchronous physical layer interfaces such as V.24, V.35 and X.21, not LAN interfaces. Another is that channel speeds are usually limited to 64Kbps for synchronous channels and 19.2-Kbps for asynchronous channels — well below LAN speeds.

A few suppliers, including Fujitsu, are developing systems of channel integration to overcome this problem. Two other suppliers, Intecom of the US and Germany's Siemens (who unfortunately do not sell their PABXs in Australia) are taking a very different approach. These PABXs interface Ethernet and Token Ring LANs directly to dedicated LAN ports on the PABX chassis itself. These LAN ports are on what is, in effect, an integral bridge which bypasses the limitations of the circuit switching altogether.

As the use of dedicated Ethernet or Token Ring ports requires the use of LAN segments, this immediately raises the question, why interface these segments to the PABX in the first place?

The answer lies in these suppliers' use of 100Mbps FDDI connections between PABXs, at least in the same locality, to carry voice, data and even video traffic, FDDI offers very high bandwidth, but does not include a means to prioritise delay-sensitive voice and video traffic over data. Siemens has overcome this, though, by including a prioritising capability within the time division multiplexing system it uses to aggregate traffic into the FDDI interface.

A very different approach is being taken by another German PABX manufacturer, Telenorma Bosch, which manufactures PC boards with an integral bridge designed to interface to the ISDN. These are becoming a popular vehicle for interconnecting LANs in Germany. Telenorma's ISDN PC cards readily interface to data modules on its PABX and, as these cards feature channel aggregation, the 64Kbps limitation can be overcome, although this requires multiple PABX ports.

Regardless of their support or non-support of LAN interfaces, some PABX manufacturers have committed to support ATM cell relay, a rapidly emerging standard for high speed data transmission.

Although the ITU-T has yet to finish defining a specific standard for the interfacing of PABXs to ATM networks, a few products falling into two distinct categories have already been announced. One approach, adopted by Nortel, is to offer an ATM interface card for the PABX itself. The other is to use a dedicated ATM switch which is either installed within the PABX itself or located adjacent to and tightly integrated with the PABX. Of the suppliers choosing this architecture, not all of which are represented in Australia, Alcatel plans to offer such a product in Europe this year, although the launch by Alcatel Australia will have to wait.

Management Lacking

As quick as PABX suppliers have been to promote the capabilities of their products to switch data, albeit only circuit switched data, they have been, as a group, correspondingly tardy in their in their offering of the necessary configuration and network management facilities. As illustrated in the table on page 30, Alcatel, Fujitsu and Nortel do support and offer a number of basic configuration attributes.

Data communications systems tend to involve cutovers of large numbers of users more often than those of PABXs, so the capability to prepare changes off-line and have them implemented with a single command is essential if data communications managers, so accustomed to such facilities on other communications systems, are to trust PABXs to carry their data.

Network management is another matter and many suppliers offer what are no more than call accounting TIMSs under the title of network management. But at least some suppliers have taken up the challenge. Fujitsu recognises this shortcoming and sees the solution in enterprise systems management systems. As National Marketing Manager John Damrow put it "the PABX should really only be considered another manageable element in an integrated multi-element environment."

The most dramatic step, though, has been taken by Nortel with the introduction of its Switchview network and configuration management system. In addition to providing all of the configuration facilities

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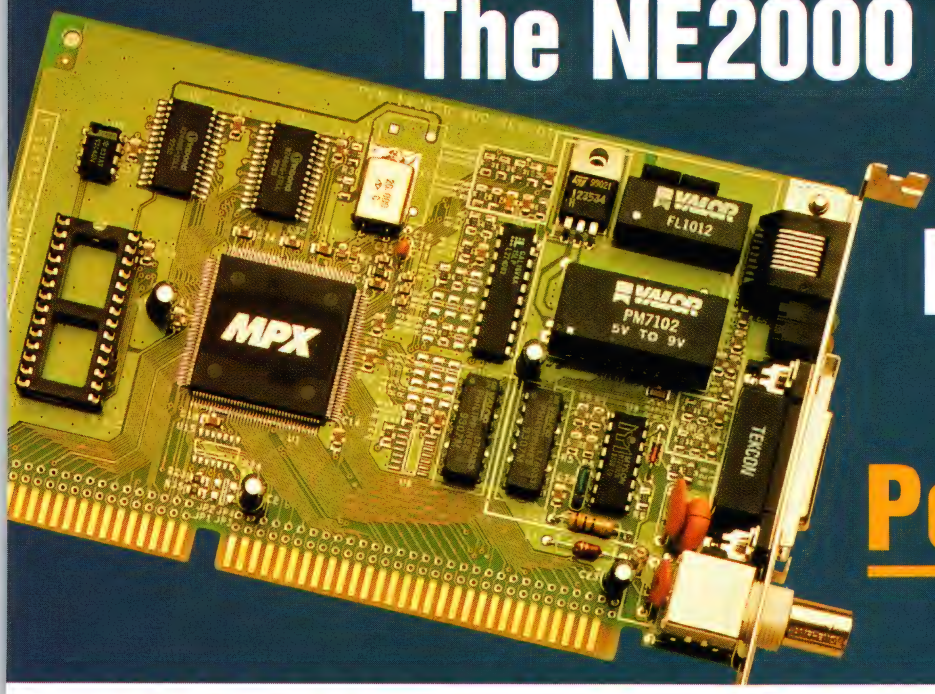

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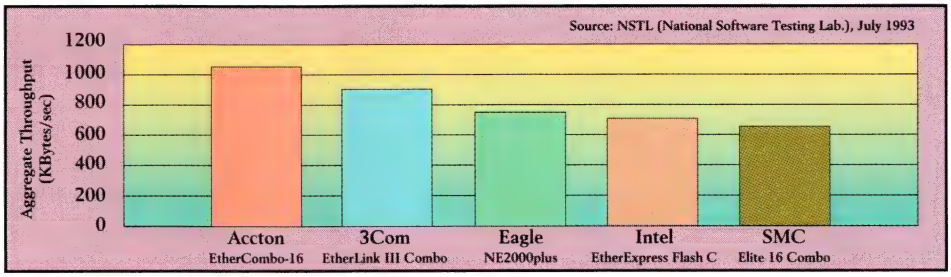

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listed in the table, Switchview incorporates the significant innovation of being able to be simultaneously connected to more than one PABX.

But as advanced as Switchview is, it still uses a proprietary PABX-to-NMS interface. Thus, Switchview can manage only Nortel PABXs and they can be managed only by Switchview.

The same limitation applies to most other suppliers, including many with far less featured network management systems that did not respond to the survey undertaken for the purposes of researching this article. But at least two suppliers have recognised the merits of using standard network management system protocols.

Alcatel of France uses the CMIS/CMIP protocol for the 4300L (which is not sold in Australia) and Intecom of the United States the SNMP protocol to interface to a network management system.

As these are industry standard protocols, the network management systems to which they interface need not be those of the PABX supplier. But even more significantly, such an NMS would enable both the PABXs and the routers, bridges, multiplexers and other data communications equipment to be managed using a single platform.

Without such an all-encompassing NMS that also satisfactorily manages their PABXs, few organisations will use the PABX to transmit data.

The Multimedia Push

Beyond the rather sober issue of network management, one new technology that has caught the industry's collective imagination is multimedia, the simultaneous transmission of real-time audio and video signals along with computer data and text. While these will generate varying volumes of data at different times during a session, the latter two can tolerate some delay whereas the former two cannot.

Using their 100Mbps local area network connections, Intecom and Siemens consider the bandwidth available to overcome a potential problem with delay. For other suppliers, though, the use of lower bit rate trunks requires a prioritisation or multiplexing scheme to prevent bursts of LAN data from delaying, and hence distorting, video and voice.

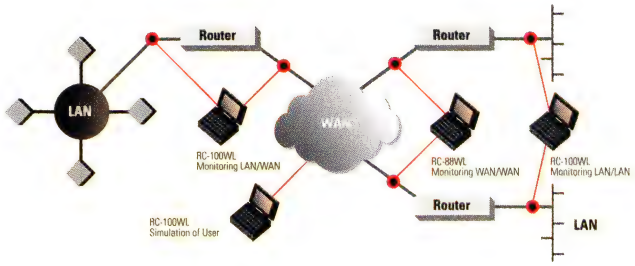
To try and solve the problem the IEEE's 802.9 multimedia committee is working on such a standard (to be called Isoenet). Based upon Ethernet but with a 16Mbps physical layer, the standard will stipulate two primary channels: a 10Mbps channel for Ethernet data and a 6Mbps channel which is itself segmented into discrete, fixed-bandwidth channels for delay-sensitive voice and video.

Above the physical layer, two standards defining protocols to integrate these various media beyond the mundane yet necessary allocation of bandwidth have recently been ratified. The ECMA-developed CSTA (computer supported telephony applications) and ANSI-developed SCAI (switched computer applications interface) standards both define application level protocols to interface a PABX's application with one running on a data communications unit such as a router or a file server. To date, the only PABX sold in Australia supporting either is Nortel's Meridian SL-1 which supports SCAI, but others are expected to follow.

With all of these potential new product offerings, PABXs may well have a role in switching an organisation's traffic beyond voice, provided their suppliers actually implement all of the interfaces and standards defined. And with these last two protocols that interface directly to a PABX's application, users could really develop some powerful networks, if only they could access and write some of these PABX applications themselves.

Stephen Coates

SIMULTANEOUS WAN/LAN ANALYSIS



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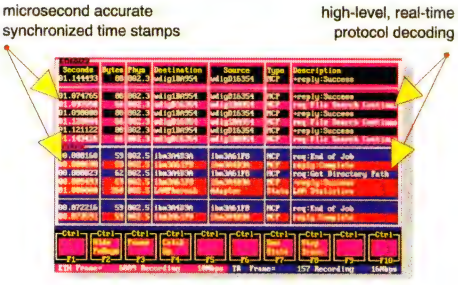

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Interview

David Farber — A Technological Rationalist

Professor David Farber is one of the old-boys of computing and communications — but he's not one of the old school. Over the years he's been involved in many diverse areas of computing, such as the development of Token Ring LANs, Petri-net modelling, the SNOBOL programming language and PL/1. More recently he has specialised in the design of large interactive networks and high-speed networks for the US National Science Foundation and Bellcore. Among the many positions he holds, he is a board member of both the Electronic Frontiers Foundation and the Internet Society, and is faculty head of Telecommunications Systems at the University of Pennsylvania. He was in Australia recently for a series of lectures organised via the Australian National University, and for speaking engagements on behalf of Electronic Frontiers Australia.

AC: *What is driving the National Information Infrastructure (NII) developments in the US at present?*
Farber: The NII initiatives seem to have passed out of the control of the government, although Gore is still pushing it a lot. The commercial interests are in control now, and so the NII will continue to grow without government help. It probably needs [Clinton/Gore] support from speeches, but also a period of 'benign neglect' by government.

AC: *How much of the controversy is about hardware development, and how much about administration and control?*
Farber: The NII is a monster with multiple heads. It's not primarily a hardware problem, but there are still some physical questions that need solutions — mainly dealing with where the high bandwidth capabilities go.

In the United States, we have the possible problem of having access-rich and access-poor regions. We faced this problem in the 1920s with the expansion of telephone services, and we solved it then by a social contract struck with AT&T: in return for them having a monopoly, they guaranteed universal affordability of the telephone. So business effectively paid, by way of cross subsidisation.

But you can't do that any more, especially in the data business, because we don't have one big company dominating this industry now. We have thousands of companies in the store-and-forward data business, and in networking. So who pays? Who knows!

AC: *For a while there it appeared as if everyone would merge with everyone else. It looked like a return to the good old days of massive monopolies in the US, but this time with combinations which owned both telephony and cable TV. But that died. What happened there?*
Farber: The cable companies were looking at telephony, and the telephone companies were looking at video. They tried to buy each other up, but when you merge cable and telephone companies you end up taking profits from one pocket and putting them into another — and in the process, you have to spend several billion dollars. That didn't make any sense, and the financial world relayed that view in the [share] market quite strongly.

AC: *Is part of this — the push for the NII, and the cable-carrier mergers — due to the fact that everyone now recognises the imminence and importance of ATM?*
Farber: I think its predictable that the base of all these developments will be ATM. You can argue ATM is not the best protocol for many services, but the driving force in telecommunications is the desire of the carriers to rationalise their long-haul network. When you look at how they actually handle long-haul in America, it's a nightmare. They have all this multiplexing, and then they need to demultiplex it each time to get at the signals they want, so the ATM-Sonet [Synchronous Optical Network; a variant, Synchronous Digital Hierarchy, is being deployed in Australia and Europe] framework is much more sensible.

AC: *Do you think the public networks will stay with ATM over Sonet or will they eventually change to pure ATM?*
Farber: I think they will go over to pure ATM and get rid of the Sonet, but some will remain 'Sonetised' for a long while.

AC: *What benefits do they get out of having Sonet with ATM over the top?*
Farber: I don't see any obvious value except that it fits into the mentality of the long-haul carriers now. With the Sonet-SDH hierarchy they can migrate out of the current [plesiochronous] carrier hierarchy without having to make all the changes simultaneously. Other than that, Sonet/SDH makes no sense. As soon as you can, you switch to pure ATM.

AC: *Are Americans still thinking of public ATM in terms of fibre-to-the-home and data-rates of 622Mbps?*
Farber: We will probably see ATM coming into the public networks as a line technology, and it will butt up against high-speed switched 100Mbps Ethernets, etc. initially. It's a very good technology. It appears to be a technology that you can integrate very well, and very inexpensively.

It is the ubiquitous nature of ATM that's so important, not its data-rate: the ability to extend it over the long-haul pipes and potentially into cable systems. So I guess ATM will win right across the board in the not too distant future.

AC: *I notice that the video-server developers are all looking at video-on-demand (VOD) using ATM protocols over coaxial cable networks. Is this the way of the superhighway? Is coaxial cable where the average person will first experience the benefits of ATM?*
Farber: You can have long debate on that. The first question you've got to ask is: are video-servers viable? Is there a market for video-on-demand?

Personally, I would not hold my breath! This is the fourth time that VOD has been promoted as the technology of the future — as being imminent. Every new generation of corporate management forgets the lessons their predecessors learned in blood; and so they reproduce the same old market plans, and hope the same old hopes. It is hype and corporate inflexibility that is driving VOD: I just don't see the market.

However, if you look at where the new business will come from for the cable operator, it's telephony; he wants his share of the big pot, especially in an unregulated environment. Telephony is an obvious new market for cable operators — and if you look at the most rational way to handle telephony over cable, you end up with ATM.

A company called Com21 is developing ATM telephony in the US for the cable networks, and it appears that they can do it for about 20% of the current telephone company costs. So cable operators will then have a digital, protected, secure world for the provision of their other services. As a side issue, there's also VOD to help them to make some money.

It could well be that it is telephony that will bring ATM into the home, because the money in cable is in telephony — not so much in cable and interactive services. ATM will come into the house at the set-top box (which is the real connectivity issue),

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and that box will handle the cells and switch them correctly, so the correct cells go to the phone, or to the video, or to a computer.

AC: *What impact do you think ADSL [Asymmetrical Digital Subscriber Line] will have?*
Farber: With ADSL, the carriers can hunt for markets without making much investment in plant, and the telcos own a lot of copper already in the ground. So if they are doubtful about whether VOD can sell or not, or whether data-to-the-home services make any sense, they can try these out with ADSL without investing in physical plant. They can test the water at a relatively low cost, and if it turns out that there's no business here, it hasn't cost the telcos very much. The alternative is for them to put fibre-coaxial throughout a community, and if they then discover that there's no business, they've got a lot of expensive cable in the ground.

But I'd guess that ADSL has only a two or three year time-frame in the US. It looks as if we're not going to have wide-screen HDTV in that time — we're going to have the same old junky TV we've got now — so if a market develops for wide-screen high-definition systems, and the people buy it, then they've got plenty of time to build new broadband systems.

AC: *Is the ADSL quality going to be good enough in the interim?*
Farber: I think the quality is probably good enough for now, but it's borderline. It's not *that* bad in terms of quality: it turns out that the eye is not very sensitive to image quality, it's the ear you've got to worry about. My guess is that ADSL will be popular because it will bring channel-choice to places that don't currently have cable.

AC: *Why the sudden spurt of interest in ISDN in the States?*
Farber: You can make the same argument for ISDN as you do for ADSL. If the telcos are not sure that data-to-the-home has good commercial prospects, or not sure that the business community really wants reasonable data-traffic flows, then ISDN is a very inexpensive way to find out.

The carriers suspect that data services may cost too much for most people, and so ISDN has suddenly become very popular as a way of them sticking their toe in the water, and checking to see just how much business there is out there. But it probably won't develop into B-ISDN: Broadband ISDN is almost finished before it starts. We might still get 155Mbps to the home, but it just won't be the old Broadband ISDN.

AC: *So you are still projecting fibre-to-the-home. Are you still thinking in those terms, or is coaxial now good enough?*
Farber: I think, as time progresses, there's a good argument for fibre — in the US especially. The present cable plants are old. If you doubt that, drive through any US community with a ham radio, and just listen to the radiation coming out of those cable trunks. It is old and it's sludgy, and it is due for replacement — and it is being replaced.

And if you are going to replace the trunks, you are foolish to use anything other than fibre, because fibre doesn't cost any more. But you probably won't see fibre directly into the house. The last link will be coaxial.

This is what I like to call the *first kilometre*. We've got to stop talking about *last mile* because it carries this notion of [one-way] delivery of information into the home. These systems had better be a two-way path or we'll lose a lot of potential.

And broadband information doesn't necessarily have to come into the home across fibre; it might come via radio in some places. We can bring bandwidth into the home in a lot of ways: but in apartments, you'll probably see fibre direct.

AC: *Can America afford to use radio spectrum for broadband delivery when coaxial and fibre alternatives exist?*
Farber: There's a lot of radio bandwidth available, but it's misallocated. Spectrum space is a capital commodity; many companies [especially in broadcasting] own nothing but the authorisation to use spectrum space — so there are powerful vested interests. If you doubt this statement, take a scanner into the busiest areas of an electronic centre like Silicon Valley, and just sit there for a while and see how much of the spectrum is really being used. You'll find it's not much.

If you could rationally allocate spectrum space (as opposed to what's done now) you'd have a huge amount of spectrum to use for new services. We already have the technologies that would allow us to do this, but the problem is that you'd take the net value of many powerful companies down to zero if you did reallocate spectrum.

The guards [between TV channels] we have in the US, and you have here, reflect 1945 technology. You don't need that amount of separation anymore, but no broadcaster would sit still if the government proposed to allocate twice the number of TV channels in a city.

AC: *Will this change in the States?*
Farber: Personally, I think not — or not for a long while; its going to be a long drawn out affair. The political power of the spectrum owners is non-trivial. And, this type of proposal is not something you can go into the streets and raise public opinion about — its tricky to explain even the basics of what you are proposing.

It is going to be a drawn-out battle.

Stewart Fist is a freelance journalist based in Lindfield, (NSW).

Encryption

Wither Clipper?

The US hot bed of data encryption has been heating up throughout the northern summer as security weaknesses have been discovered in the Clipper chip.

Beloved by the US Government looking for a convenient technology to support wire taps on data, voice, and other forms of modern communications, the self-same Clipper is despised by US hardware and software vendors that view it as a silicon chain restraining them from entry into a lucrative global encryption market (see 'Clinton's Clipper: Can it Keep a Secret?' in the December/January 1994-94 edition).

Presently the Clipper is the only advanced encryption technology that can be sold overseas by US vendors, severely limiting their ability to compete in a global encryption marketplace. However, by incorporating it into their products, US hardware and software vendors are faced by an international market that wants neither to provide the US Government with an easy back door into their systems nor to have their choice of algorithms limited to the Clipper's Skipjack.

Together with reports that the chip's Digital Signature Standard (DSS) is flawed, the most recent blow to Uncle Sam's darling among microprocessors was ironically not from one of the many irked vendors — like Microsoft and Software Publishing Association — but from long-time Clipper advocate AT&T.

Embarrassing For AT&T

Dr Matthew Blaze, a research scientist with AT&T Bell Laboratories, was testing the robustness of a prototype telephone encryption PCMCIA card earlier this summer. Based on a Capstone encryption chip that uses a key escrow technology very similar to that of the Clipper, Blaze found a way to beat the chip's law enforcement access field — or LEAF — that would be used by the police for court ordered wire tapping.

According to Blaze, technologically adept criminals could use the Capstone or Clipper chip to create a LEAF that even the US Government cannot decode.

Embarrassed by the discovery, AT&T was nonetheless quick to voice its continued support for the Clipper chip.

Because this process would require a full half hour to perform the programming necessary to fool the chip, AT&T spokesperson David Arneke said that Blaze's discovery would have few ramifications on voice applications. "Very few people are going to wait 30 minutes just to make a phone call," he said.

AT&T representatives explained that because Blaze was researching a prototype

Technology Update

Network Management With OneVision

There's been some behind-the-scenes wheeling and dealing in the network management market recently, culminating in the announcement that AT&T has chosen Hewlett-Packard's OpenView to form the basis of its new OneVision integrated network management offering. Launched in Australia last month, OneVision is a framework for providing end-to-end network and systems management. It will offer users a range of applications, both from AT&T and from third parties such as Cisco and Cabletron, and will be initially available for both Unix and Windows NT. It replaces the Starsentry offering, which was built around a platform from Netlabs. However, Netlabs won't be feeling the blow too much, since it is now licensing some key elements of its Dimons package to HP (and consequently to AT&T). According to Netlabs officials, the company is moving to get out of the platform market, preferring to concentrate instead on OEMing its technology suite. To this end, it will provide HP with the source code for its Nerve Centre Unix SNMP alarm correlator, and a set of APIs that support both SNMP and CMIP (Common Management Information Protocol).

US Encryption Technology Falters

The Clipper chip, which has been developed by the US National Security Agency as a kind of electronic key for the encryption of sensitive data used by government agencies, has long been beset with difficulties (the most recent being claims that the Russians have already seen the underlying technology). But it now appears that the Digital Signature Standard (DSS) which was to be implemented on the chip may itself not be able to deliver the foolproof authentication promised. In May, DSS developer NIST (the National Institute of Standards and Technology) announced that the US Department of Commerce had granted approval to DSS as Federal Information Processing Standard 186. But this was quickly followed by reports indicating the DSS hash algorithm could have a flaw that would let hackers forge signatures and make changes to supposedly secure documents. The problem was serious enough to send NIST engineers rushing back to the drawing board, but the company now claims all that's required is a one-line fix which has already been prepared.

Mix and Mux Voice/Data Modems

New modems that can carry voice and data on the same line have come onto the market to meet the needs of users of document conferencing applications, such as Intel's Proshare. However, the few units available use proprietary technology, meaning they must be deployed in pairs. The Telecommunications Industries Association (TIA) is moving to swiftly rectify this situation, with the TR30.1 modem standards group working on a spec to define how modems multiplex voice and data. The TIA also plans early next year to present a proposal for an international standard which addressing voice/data multiplexing to Study Group 14 of the ITU's Telecommunications Standardisation Sector (ITU-T). At present, Multi-Tech System's MultimodemPCS can statistically multiplex voice and data onto a single line at 19.2Kbps, while Phylon has a V.32*bis* chip that implements a similar technique.

Austel Releases Paper on Telecoms Standards

Austel has released a public information paper called *Telecommunications Standards and Conformance Infrastructure in Australia*, which describes Australia's telecommunications standards and equipment testing and conformance infrastructure and presents an overview of Austel's vision for the future regulation of this area. Those interested in obtaining a copy of the paper should contact Richard Marshall at Austel on (03) 828 7335.

International Messaging

The world's four messaging associations — the Electronic Messaging Association (EMA), the European Electronic Messaging Association (EEMA), the Japan Electronic Messaging Association (JEMA), and the Electronic Messaging Association of Australia (EMAA) — have announced steps to improve the level of global co-operation. The four organisations, which have traditionally met regularly to promote international co-ordination of their activities, have decided that they will each adopt the role of 'global champion' for an important messaging issue. Under the scheme, EMAA will have responsibility for electronic commerce, and EEMA for directories issues. The associations also agreed to jointly publish a Global Guide to Messaging Products and Services, to be released in January 1995.

Olicom Achieves Certification Firsts

Danish network equipment supplier Olicom has announced it is the first vendor to have its lab accredited for in-house certification of NetWare LAN compatibility. The accreditation, awarded under the Novell Certification Alliance, authorises Olicom to run testing to high standards to ensure its products are 100% NetWare compatible. The company is also the first vendor to receive IBM-endorsed certification that its Token Ring bridges and stackable hubs are fully compatible and interoperable with IBM LAN Manager.

computer-to-computer, electronic mail encryption device rather than the Clipper's existing voice, fax, and low-speed data transmission applications, 'his findings should be helpful to the National Bureau of Standards as it explores future applications of the Government standard' in data and other forms of encryption. AT&T was the first company to endorse the chip, and has plans to add Clipper to its cellular phones.

Other vendors have been less generous in their assessment of the discovery.

"The Clipper has been touted as something law enforcement really needs," said Jon Roberts, President of Virginia-based encryption manufacturer Tecsec. However, Roberts believes that this will soon come to an end. Within a year's time, he predicted, the Clipper will no longer be the only alternative to US encryption needs.

Instead, Roberts sees companies possessing private keys to encrypted files. During investigations, US law enforcement officials can subpoena privately held keys through courts in much the same way they request search warrants.

"Some people argue that the companies could just throw the keys [to incriminating data] away," Roberts said, anticipating debate. "But then they would not be able to access their own files."

The primary advantage of this arrangement would lie in US corporations' ability to choose their own encryption technologies — like the National Institute of Standards and Technology's DES (Data Encryption Standard), the popular PGP (Pretty Good Privacy), Tecsec's P-Squared algorithm, or Europe's Idea algorithm.

With Clipper's image tarnished in light of the Blaze research, now not only disgruntled software vendors are exploring alternatives to the Clipper chip.

In a July 20 letter to US congresswoman Maria Cantwell — a Clipper Chip opponent — US Vice President Al Gore called for the development of a more comprehensive encryption policy, which will be voluntary, exportable, not rely on a classified algorithm, and be based on 'an export policy that does not disadvantage American software companies in world markets.'

This willingness to explore other encryption technologies besides the Clipper Chip "is a breakthrough," according to Doug Miller of the Software Publishers Association. "The letter says things in print that have never been said before."

Referring to Gore's call for a voluntary, exportable encryption with private escrow agents, Miller noted that Gore is describing a technology quite distinct from Clipper.

While the US Government will continue supporting the Clipper Chip as a federal standard for telephone communications, Gore wrote that the government would 'investigate other technologies' for computer and video technology.

Without specifying the alternative technologies, new public policy on encryption could potentially let US companies compete in a global encryption marketplace.

According to US industry experts, by limiting the export of cryptographic software the Clinton administration is denying US companies entrance into a $US6-7 billion industry. As US companies remain isolated from the global encryption marketplace, non-US manufacturers are thriving in a market with no US competition.

But the US Government fears that releasing its encryption technology to foreign countries will damage national security. For this reason the Clinton administration continues to classify encryption as a munition and restricts its export as if it were artillery.

Brian Riggs

Electronic Mail

The MADMAN Cometh

Major vendors Lotus and Novell aren't mad — they are just thrilled about an Internet standard for managing e-mail routers via SNMP. Dubbed MADMAN, the Mail and Directory Management MIB (Management Information Base) is the "first step on a very long road" to alleviating problems associated with e-mail, says Ned Freed of the Internet Engineering Task Force (IETF). MADMAN provides a simple health check for an e-mail system, and monitors the flow of messages — an otherwise time-consuming task for network administrators.

Almost 20 vendors in the independent Messaging Management Council (MMC) — including AT&T and Intel — are enthusiastically supporting MADMAN and will work directly with the Electronic Messaging Association to adopt a specific implementation schedule. Isocor, Novell and Lotus are already in full-fledged implementation development. Others are supporting MADMAN but have not decided on an implementation date.

"It's up to the vendors to continue to work together to adopt MADMAN," MMC Chairman and Isocor Vice President David Knight explained. He says the group tossed around other possibilities in terms of management, including inventing their own format, but MADMAN was the "best near-term vehicle for implementation of message system monitoring across enterprise networks." In the end, the vendors focused their attention on what users would want.

Such is the case with Lotus, says Ed Owens, Director of Technical Relations for cc:Mail. Lotus is already implementing the standard in its Lotus Communications Server for Notes and cc:Mail for early 1995.

Microsoft, on the other hand, has not pinned down an implementation date, but is supporting MADMAN. Tom McCann, Program Manager for the Microsoft Exchange messaging project says there are three main reasons Microsoft is committed to MADMAN. One, it is based on SNMP, a network management standard with a high degree of installation. Two, while the MADMAN MIB is initially a basic framework, it will be easy to add to and modify in the future. Three, McCann said, "It exists and we don't need to recreate anything."

Freed, co-author of the standard, emphasises that the current MADMAN specifications solve the first and most important problem of flow control. The MIB can tell if a message transfer agent is working, and the age of the oldest message. It monitors crucial elements of the mail system such as receiving, sending, storage and size.

But tracking individual messages, for instance, is not yet possible. Freed said this problem will be tackled in the future. Monitoring and controlling messages and gateways will be worked on as well.

Erin English

ATM from page 28

ually set to keep within a 10Mbps count, delivered an average throughput of 9.7-Mbps. The test allowed the LARA group to put its finger on one of the major shortcomings of today's implementations of ATM technology: there are no links to pass quality-of-service parameters, like bandwidth reservation, through to the application level — where users need them the most. Without such links, bandwidth allocation can be neither dynamic nor transparent. This shortcoming will have to be rectified before ATM applications appear.

The first phase of the LARA tests makes the need for a new batch of standards eminently clear. Recent progress on signalling is a major step in the right direction. But standards are not enough. ATM vendors and carriers alike will have to implement the full battery of services promised by the cell-based protocol if users, small and large alike, are going to spend heavily to lay the foundations for corporate multimedia. That is why the LARA project in its second phase — scheduled to start late this year — will focus its attention on LAN-to-WAN connectivity for ATM.

Jocelyne Lemagnen is head of the network architectures group of the Direction des Etudes et Recherches of Électricité de France. Robert Mandeville is the director of the European Network Laboratories (ENL), a vendor-independent organisation that tests network hardware and software.

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WAN VIEWS

Standards — Imposition Can't Beat Acceptance

Gerard Joseph

It does not seem to me that anything of technical merit can suffer from being exposed to discussion, and so it is with the great OSI vs IPS debate (although, perplexingly, some regard it as injurious to OSI). For that reason, I believe the US Federal Internetworking Requirements Panel (FIRP) report, now published in its final form, has done a service to the networking community in formally tabling and opening up for public discussion an issue on which debate had previously been conducted in muted tones.

However, for a debate to be effective, there are two important conditions: the opposing sides must agree on the interpretations of the terms and concepts under discussion, i.e. they must share a common 'language of discourse,' and the participants must argue *ad rem*, i.e. objectively and to the point. Unfortunately, these conditions have not always been observed in the OSI/IPS, debate where the real issues are all too often obscured by a haze of religious fervour.

It was therefore refreshing to see some clear thinking brought to bear in Melbourne in late June at a public meeting held under the sponsorship of EMAA (Electronic Messaging Association of Australia) and EDICA (Electronic Data Interchange Council of Australia). This was one of the more interesting sideshows in the current protocol wars and protagonists from both sides of the issue took part; notably Alan Lloyd on the OSI side and AARNet's Geoff Huston on the Internet side, as well as several 'non-aligned' participants. While at times the debate took a rancorous turn, I was pleased to see that at least one speaker drew the important distinction between the Internet per se and the Internet Protocol Suite (IPS, often known imprecisely as TCP/IP). Networks and protocol suites have different sets of attributes and issues, and it is misleading to compare one with the other.

OSI, of course, is only a set of protocols — there is no OSI equivalent of the Internet, in the sense of a global network running a full OSI stack pervasively.

The Melbourne debate exposed some of the views of the ISO (International Standards Organisation) and IETF (Internet Engineering Task Force) standards processes as seen by their respective opponents. Here, it seems, more than in allegiance to the resulting protocols, is the greatest source of division between the two camps, and perhaps the greatest cause for pessimism in the hope for genuine technical collaboration. Perhaps it is all too easy to ridicule the ISO process, as some are wont to do with cute aphorisms. On the other hand, how does one challenge the IETF principle of 'rough consensus and working code'? It seems difficult to argue with a process that requires at least two independent and mutually interoperating implementations before a protocol can be designated a standard, even if such pragmatism is at the expense of a certain democracy in the underlying process.

The effects of an exaggerated democracy can be seen in the presence of both connection-oriented and connectionless network protocols in the OSI suite. In the July edition, my fellow columnist Alan Lloyd argued that this was a deliberate decision by ISO and that each protocol has its own technical justification. That's true, but it fails to acknowledge that it was a political decision, settled in response to the opposing preferences of the US and European ISO delegates. While it is possible to build conformant OSI networks of either kind, there is no OSI standard for interworking between a network using the OSI connection-oriented network service and a network using CLNP.

The issue of democratic consensus in the ISO standards process leads to the question of vendor support. Alan asks why vendors who have long participated in the OSI process apparently have difficulty implementing the resulting standards, or claim there are deficiencies in them. To the extent that the premises of the question are valid, the answer lies in the nature of the ISO process. ISO ballots are voted on by national standards bodies, not by individual organisations. Since the position taken by a given national body is itself determined by the positions of those organisations that are active within that national body, there is no reason why the result of an ISO ballot should reflect the position of any particular vendor or other organisation. Further, because of the numerous compromises that invariably occur in the development of an ISO standard, it is unlikely that any organisation will unequivocally support the final form of the standard.

Given the vagaries of the ISO process, is it prudent to adopt a view that ISO standards are good in themselves, and require no further justification? A more tenable position would surely be that international acceptance is the defining characteristic of a good standard, and should ideally be the criterion for an ISO standard. Enter IPS, which some describe as a US standard, when in fact it is not a US national standard but a de facto standard of US origin having international acceptance — even in Europe. Many organisations that would not commit their mission-critical applications to the Internet (for valid reasons) are perfectly happy to commit them to Internet protocols on their private networks (a point that emphasises the importance of the distinction I made earlier).

"Given the vagaries of the ISO process, is it prudent to adopt a view that ISO standards are good in themselves, and require no further justification? A more tenable position would surely be that international acceptance is the defining characteristic of a good standard, and should ideally be the criterion for an ISO standard."

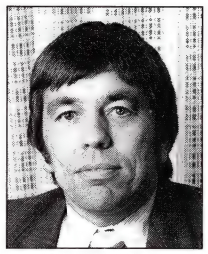
Finally, a word about layers. I stand by my comment to the effect that OSI protocols essentially address just the top four-and-a-half layers of the seven-layer stack (see 'Balance Needed in Internet/GOSIP Debate' in the May edition) which was made in response to assertions by Alan that widespread implementation of X.25 was an indication of the widespread acceptance of OSI. My point is this: that protocol stacks are unique only above the subnetworking layer, that the essence of OSI is not X.25 but CONS, CLNP, and so forth through the application layer. I have a feeling that Alan agrees with me on this; that he would not be happy if the only implementations of OSI were restricted to X.25 subnetworks running non-OSI protocols!

Undoubtedly the debate will continue, but in the meantime (and as Alan points out in his column this month) we should all look forward to a convergence (not integration) and harmonisation of the existing network-layer protocol standards.

Gerard Joseph is a Senior Systems Engineer with IBM Australia. He is based in Canberra (ACT).

OPEN SYSTEMS

IPS and OSI Harmonisation — An Update



Alan Lloyd

Recent articles in these pages have uncovered a wide disparity of views on the great OSI-IPS debate — particularly the significance or otherwise of a recent report from the US Federal Internetworking Requirements Panel (FIRP), and the US ownership and administration of the IP address and its limited four-byte form.

Since this debate started, both sides of the argument have been well aired and now that the dust is settling, there is a strong desire emerging for the harmonisation of global networking and internetworking. This is taking a number of forms which I'll outline below. (But note that the information provided is still 'working information' and therefore details may change.)

Since its original release, the FIRP report has been updated considerably and includes some significant new points. These are:

- It now recognises NOSIP (the NATO GOSIP) and the fact that the aviation industry is using OSI;
- It also recognises that the ITU is a treaty organisation under the auspices of the United Nations for delivering global standards (and addressing) and is recognised by the carriers and standards bodies in member countries;
- It recommends that one addressing standard should be sought for global interoperation and that the international community and governments only seek addressing schemes as administered by national or internationally recognised bodies.

These points are significant because once a common addressing scheme is sought, then the protocol choice becomes self-evident.

From a standards body perspective, the liaison between the Internet Engineering Task Force (IETF) and ISO-SC6, who deal with OSI networking standards, is also making considerable progress. There is a Memorandum of Understanding between the two organisations and ISO will be referencing RFCs in its own standards while the IETF will be providing input and its RFCs into the ISO standardisation process. ISO, for its part, will not slow the standardisation process for RFCs by lengthy procedures. Both groups will participate in the development of commonly desired standards.

". . . from a technical perspective the harmonisation process between IPS and OSI (CLNP and NSAPs) is really starting."

With respect to IP harmonisation and evolution, the three options proposed for IP Next Generation (IPNG) which are SIPP, CATNAP and TUBA will be blended to form a consolidated SIPP as the basis for IPNG. CLNP, the ISO version of IP, will be upgraded with enhancements for its Broadcast and its Quality of Service functions and aligned with IPNG. So from a connectionless internetworking service level, IPNG and CLNP should become equivalent.

The network addressing issue is still under finalisation at the time of writing and the choice for the new IPNG is believed to be a sixteen-byte address field instead of its old four-byte field. The unfortunate fact is that ISO's NSAPs are twenty bytes so they will not quite fit. However, NSAPs will be incorporated into IPNG (although mapping issues are still under discussion). It should be noted that as IP (and the Internet) incorporate ISDN, B-ISDN and ATM technologies for switched broadband, then Q.2931 (ex Q.931/B) network signalling schemes will have to be supported. Q.2931 supports E.164 numbering plans (as used by the telephone system) and NSAPs. So ITU numbering plans and NSAPs certainly should have a place in the new protocol (and the Internet). This support could be similar to the mechanisms used by X.25 where NSAPs are carried as facilities or optional address forms. So from a technical perspective the harmonisation process between IPS and OSI (CLNP and NSAPs) is really starting.

From an operational perspective the harmonisation issue will still require some considerable effort. Although there are announcements that IPNG should be backward compatible, it is difficult to see how one can rapidly upgrade an operational network that spans many countries and organisations with software that permits the old addressed components to interwork with the new addressed components. Changing addressing schemes in the past (in simple devices like routers rather than intelligent PABX systems) has usually meant a network switch-off situation. Certainly there will be many devices out there that will need upgrading even if it is just to make them robust to receive protocols with different versions of IP, let alone process the new and longer address forms. The management of this upgrade, if one is running a commercial service on such a network, will be fundamental.

Another aspect of this harmonisation is that of the long term direction with addressing. This has been raised in my previous articles. ITU/ISO NSAPs not only provide an internationally administered addressing scheme but within this scheme there are internationally recognised routing and administration hierarchies. For example, routing levels for aircraft, ships, transport systems and network devices can be assigned uniformly across the world, and from a registration perspective, countries, governments and corporates can be assigned uniformly for the address administration in line with the routing hierarchies. Therefore the OSI NSAP should not be seen just as 'twenty bytes,' but a formal approach to global network interoperation and address administration.

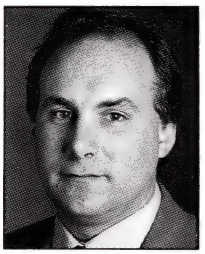
IPNG will naturally remove the addressing restriction of the current IP but the issue of allocation and structure will have to be resolved. Again having two totally different schemes here (one based on, for example, CIDR and numbers and the other based on internationally recognised routing and administration hierarchies) will cause large scale interworking problems. At the end of the day, both will have to interoperate so products will now have to be sought that permit the IP-IPNG and the OSI protocols and their addresses to harmonise.

One aspect of network addressing that is fundamental and does escape many people is that the addressing scheme used for a network dictates its design methodology. For example, with a conventional SNA network one designs the network with PUs and LUs and the network is styled on the 'host centric' approach — although with APPN, LUs are distributed. With TCP/IP one designs a distributed network with a set of numbers (and subnet masks) which one configures across the system — hopefully a notion of geography is introduced into the format and allocation of these

Continued on page 44

LAN VIEWS

Getting Out and About



Graeme Le Roux

A lot has been said about mobile computing and remote access, but relatively few people have actually tried to do much more than work in an airport lounge or a hotel room with a laptop. There is no doubt that this is both possible and practical, however this is not the same as 'being on the network in the office.'

First of all, a roving user will not be using a network interface card. That means that the user will not have the bandwidth available to work as he or she does in an office. Saving a file every two or three minutes is a great idea on an Ethernet, and it's fine on an ISDN connection, but it will quickly drive a user mad if it means establishing a modem connection for each save. The solution is to work with a local disk and then upload the files being worked on via the modem. This implies that the user is computer, or communications, literate enough to do this (i.e. save files as a set, establish the modem link, upload the files, and then shut down the link).

There are a number of ways of hiding some of this communications plumbing; Lotus Notes, for example, permits the design of systems based on database replication, and as a result it is relatively straightforward to deploy a system which permits a user to simply hit a key sequence (or GUI button) which causes a pre-programmed link to be established and a data set to be uploaded to a server, but it won't physically connect the modem to a wall socket. An alternate approach is to use a messaging architecture such as Microsoft's MAPI. The consequence of this latter approach is that designers of systems built in Microsoft environments need to consider using MAPI as a transport mechanism rather than a simple real-time API such as, for example, Windows Sockets or OLE. In either the Lotus or the Microsoft product set the tools exist, but you have to use them properly.

Applications such as those discussed above have their limits; what does the Notes user do if he/she suddenly has to send a fax? In a business lounge or a hotel a fax might be available, but what if one is not? In any case how is the user supposed to print the fax so it can be sent via a standard fax machine? The answer is a fax modem and appropriate software which the user will have to know how to use. The user also has to know when it's safe to connect the modem. As any long-time user of modems is well aware, connecting them through some types of PABX can be a problem. But there is an alternative — use a mobile phone.

Many mobile phones support a data connection, usually via an optional device. For example, I'm writing this piece in a lounge at the dealership where my car is being serviced, the phones here are the cordless radio type and, while there is a fax machine I don't have printer and in any case I have to send this to *Australian Communications* via modem as text and then send a fax just in case of corruption. What I will do when I finish writing is upload the file via the modem in my laptop as text, then insert the file in a fax form and send it to Aus Comm's standard fax.

For those interested in the details, my laptop is a Compaq Concerto 33Mhz 80486 with a 250Mbyte hard disk running Windows for Workgroups version 3.11 and Microsoft Office version 4.3. One of its two PCMCIA slots contains a NetComm Automodem E7F fax modem, and the other contains a 3Com PCMCIA Etherlink III-Combo. My mobile phone is a Motorola Micro TAC Ultra Lite which I connect to a Motorola option called The Portable Cellular Connection (TPCC). The TPCC presents a standard RJ-11 connector to the modem. In fact the RJ-11 is a standard telephone socket in all respects and supports both tone and pulse dialling. The TPCC, like the phone runs off either a battery, mains or car adaptor. But before you go out and buy all this stuff you must understand the limits of this set-up.

First off, Microsoft does not provide support of Pen Windows in Australia; this is left to Compaq (the Concerto uses a pen instead of a mouse — forget the handwriting recognition). Pen Windows is effectively a few DLL-based additions to standard Windows, as is Windows for Workgroups, and so you can install WFW add-ons for Windows 3.1 to upgrade Pen Windows just like standard Windows — but Compaq consider this as 'unsupported.' Similarly, the only network adaptor which is supported by Compaq for the Concerto is the one built into their Concerto docking station. This means that you may get little help when you find you can't configure your PCMCIA network adaptor.

PCMCIA cards depend on two services; Card Services and Socket Services. The former reserves memory and ensures that only clients for that card are allowed to access it (e.g. a network card driver can't access a modem) while the latter provides the hooks to configure the PCMCIA adaptor for use. Unfortunately Socket Service's structure is inherently incompatible (at this stage) with most network adaptors — this is not just a problem with Compaq machines or 3Com cards — so NICs ignore them — all you can do is turn the card on or off.

"In practical terms you simply have to take the best bandwidth you can get — 9.6Kbps in a good signal area is possible, 14.4Kbps borders on impossible in most places — and accept the fact that you can't really work on the move; you have to be stationary."

The Etherlink PCMCIA is also unknown to WFW version 3.11 — this is no problem just select Unlisted or Updated Adaptor during the install process and follow the prompts. You should also be aware that both Card and Socket services are real mode TSRs so the drivers for your PCMCIA adaptors will have to run in real mode — in my case that means an NDIS 2.x driver. The PCMCIA specification is also written in terms of ROM access speeds so don't expect your PCMCIA NIC to run as fast as its ISA or EISA equivalent.

Then next bit of fun is shoving a nice fat data pipe down the narrow bandwidth channel provided by a mobile phone, not to mention what happens when you hand off from one cell to another or when you are in a poor signal area. In practical terms you simply have to take the best bandwidth you can get — 9.6Kbps in a good signal area is possible, 14.4Kbps borders on impossible in most places — and accept the fact that you can't really work on the move; you have to be stationary. Note that compression is largely irrelevant here, it's the data speed, not its content, which is affected. You use the best error correction and compression protocols you can.

Graeme Le Roux is a Director of Moresdawn Pty Ltd (Bundanoon, NSW) and specialises in local area network consulting services.

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Open Systems from page 41

addresses. However, the notion of logical addressing (e.g. tactical units, ships or aircraft) or dynamically extensible subnets are usually not considered in this type of (data only) network.

Again, protocols which dynamically allocate IP addresses are being provided, but what are the scaling issues here? With NSAPs and carrier global numbering plans (and X.400 addresses and X.500 names) the network design by definition fits the network directly into the global routing and addressing hierarchy. Also, because NSAP addresses have internationally recognised logical and geographic routing hierarchies, the network design, certainly in my opinion, is more natural and globally scalable. Hence OSI and NSAPs is about global networking.

Although this harmonisation with OSI/CLNP and IPNG is only related at the network level, other areas of technology will be addressed in the future, e.g. TCP and RFC1006 brought some transport service harmonisation with OSI applications. Because of similarities, the ISO Transport service will align and probably TCP will become the standard Transport service — as it is very similar to some of the ISO Transport layer functions. Other areas of harmonisation include compatibility between X.400 and MIME (Multipurpose Internet Mail Extensions), X.500 support of the Internet and IPS, and possibly the evolution of SNMP to CMIP (Common Management Information Protocol).

This last case, although it may some way off formally, will happen simply because SNMP was designed for LANs and connectionless networks. Because of this, SNMP only really manages interfaces, status and statistics as flat management data. With connection-oriented networks such as wide area B-ISDN and ATM, full object methodology will have to be used in the system design and the managed objects used will require naming components in the protocol (as per CMIP) to access them.

Therefore the internetworking migration/harmonisation process for management will be to migrate the network protocols to IPNG/CLNP, and as the new network services are established over switched broadband, the move from SNMP to CMIP will occur. This CMIP direction is already being supported by the major management platform vendors with the introduction of CMIP and GDMO (Guidelines for the Definition of Managed Objects) facilities (as their core platform architectures).

For the user, the IT industry will be providing the tools and gateways for this IPS-OSI networking evolution and harmonisation, and the networking issues will therefore be the same as in the past: ensuring that the IT system design and operational plans incorporate the new technologies as appropriate and that the support for this process is provided by the equipment/service supplier. Certainly the support for NSAPs in both the end systems and the networking equipment is essential. So this should be part of the stated procurement requirements.

In closing it is pleasing that the IPS-OSI harmonisation process is occurring in a positive manner. The important factor is that both technologies are now fully recognised for what they are. Certainly, both technologies and their harmonisation process will be important to the planning of our commercial and government IT systems, as well as to our academic IT networks and the country's IT educational programs.

Alan Lloyd is Strategic Developments Manager for Datacraft Australia Ltd (Melbourne, VIC).

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Take Control of Dispersed LANs

Somerset's software suite allows central-site managers to oversee far-flung NetBIOS LANs via SNA or X.25 links.

Corporations that for years have been connecting large numbers of branch offices to the mainframe over SNA or X.25 links face a management crisis when they install LANs at those sites. It's not feasible to add scores of LAN administrators to the payroll to oversee these LANs, but it's also impractical to build a parallel router network just to manage them.

Sydney-based Somerset Systems is offering a suite of products than can turn this sticky situation into a cohesive management scheme — without putting a severe strain on the budget. Four software packages — NetRouter, NetGlue Extra, NetMirror, and GLAM — give central-site managers the means to control large numbers of NetBIOS LANs across installed SNA or X.25 links.

NetRouter and NetGlue Extra are gateway packages which allow NetBIOS sessions to be established across SNA or X.25 links in place between the mainframe and remote Ethernet or Token Ring workstations and servers. NetRouter handles the extension of NetBIOS sessions over SNA or X.25 WAN links, overriding differences in underlying protocols like TCP/IP or NetBEUI. The package encapsulates the NetBIOS payload in SNA or X.25 packets and spoofs NetBIOS to prevent broadcasts from consuming valuable WAN bandwidth. Somerset says managers can add new sites to the system while the network is operating.

NetRouter software must be run on top of a third-party gateway (X.25 gateways for OS/2 servers are available from IBM, Atlantis, and Eicon; SNA gateways can be purchased from IBM DCA/Microsoft).

The Somerset gateway sets up a NetBIOS session by telling its lower-level counterpart to establish a circuit across a WAN link with a remote lower-level gateway. SNA gateways set up twin half-duplex APPC connections to allow a full-duplex NetBIOS session. X.25 gateways set up one virtual circuit for each NetBIOS session.

The second gateway package, NetGlue Extra, is used for two other purposes. The first is to connect two dissimilar LANs at the same site: in this case, the software enables NetBIOS sessions to work around differences in LAN type or protocol. The second is to set up a NetBIOS session between the central site and a remote site over ISDN. In this case, the software works in tandem with an ISDN basic-rate interface adaptor and software sold by Network Designers KNX.

Automation Routines

Both NetRouter and NetGlue Extra can be used standalone or they can act as platforms for the vendor's NetMirror and GLAM packages, which are NetBIOS applications for developing programs to automate management chores.

NetMirror allows a central-site manager to take the reins of remote users' terminals. The actual screen information, keystrokes, and mouse clicks are transmitted over an SNA or X.25 link via a NetRouter NetBIOS session. GLAM (for Global LAN Administration and Management), functions as a job scheduler to let users define tasks and export them for execution by groups of workstations or servers. GLAM provides the mechanism for doing this, rather than undertaking the tasks itself. This means GLAM isn't limited to supporting an already established roster of management tasks; users can write new ones or exploit GLAM to support end-user applications.

GLAM's main components include a front-end application, a database, and a GLAM control engine and GLAM Daemon Master at the central site. GLAM Daemons, or agents, run in all equipment to be controlled by the system (see the figure).

GLAM in Action

GLAM works like this: the front-end application provides users with prompts to guide them in defining tasks. Once a task has been defined, it's stored in GLAM's database, and the GLAM control engine converts it into an OS/2 DLL (Dynamic Link Library) program. Copies of this program are dispatched to the specified workstations and servers via NetBIOS sessions. At the scheduled time, the Daemons in each remote machine run the DLL program and forward the results to the Daemon Master at the central site. The Daemon Master writes the results to the database, or passes them on for processing by another program, which in turn might trigger further tasks.

Somerset System's customers include the Commonwealth Bank of Australia, which uses NetRouter to link LANs at 1,100 remote sites via an SNA network, and the Government Insurance Office, which uses NetRouter to oversee LANs at 130 sites over X.25.

Peter Heywood

PRODUCT SUMMARY

Name: NetRouter, NetGlue Extra, NetMirror and GLAM

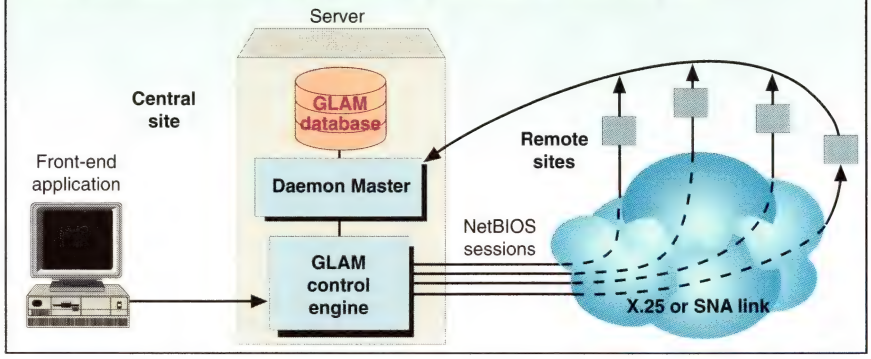
Description: Cohesive LAN management system which allows the control of large numbers of NetBIOS LANs across SNA or X.25 links

Price: NetRouter: around $4,000 per server; NetGlue Extra: $1,795 per server; NetMirror: $250 per workstation; GLAM starter kit with 10 Daemons: $25,000

Vendor: Somerset Systems Pty Ltd, Suite 1, 207 Ben Boyd Rd, Neutral Bay NSW 2089 Tel: (02) 908 2988

A Mechanism for Remote LAN Management

GLAM's front-end application helps administrators define tasks, which are then stored in a database. The GLAM control engine implements each task as an OS/2 Dynamic LInk Library program and dispatches it to target machines at remote sites. The program runs at the scheduled time, and the results are sent to the Daemon Master, which writes them to the GLAM database or sends them for processing by another software program.



One Box, One Price, No Fine Print

ACC's new Danube branch office multiprotocol router breaks the price barrier — software included.

Keep it simple, keep it small, and keep it cheap. Over the past year, these three rules have become a mantra for makers of branch office routers. Leading the chant now is Advanced Computer Communications, which recently began shipping a multiprotocol branch office box with a price tag just over $4,000.

Danube, ACC's first-ever branch office router, is aimed squarely at the smallest sites. The box, which comes with one LAN and one WAN port, measures 4.6 by 17.9 by 29.9cms and weighs less than 1.8 kilograms.

At $4,262, the Danube is competitively priced against branch office price leaders, such as the RouterPR from Hewlett-Packard, which supports IP and IPX. Danube's price is all-inclusive: each box comes with IP, IPX, and AppleTalk routing software, as well as a number of advanced software features that were developed by ACC for its higher-end router offerings.

Danube has a lot of company in the branch office router market. The past six months have seen the arrival of a slew of such devices, including the Cisco 2500, the ILAN XL 2 from Crosscomm, and the Access Node from Wellfleet Communications.

But ACC's one-price-buys-all policy bucks a recent trend among router makers like Cisco and Wellfleet to price hardware and software separately. Included in the Danube software suite is an SNMP software agent that allows the router to be managed by a central-site SNMP management console. Danube also works with PPP (point-to-point protocol), a specification developed by the Internet Engineering Task Force to promote router interoperability.

The unit comes with a removable WAN card that can support one of five interfaces — EIA-232, V.35, RS-422, X.21, or ISDN basic-rate interface (the unit can aggregate both BRI B Channels). On the LAN side, the box offers one Ethernet AUI and one 10Base-T port.

The Big Squeeze

ACC has equipped the Danube with three bandwidth optimisation features to help remote sites squeeze the most efficiency out of their costly WAN link. These features include data compression, dial-on-demand, and Express Queuing.

The Danube data compression scheme achieves a best-case compression ratio of 4:1, depending on the type of traffic. The Danube isn't alone among branch-office boxes in offering compression however, the vendor claims that this is the first router that can compress traffic over frame relay links. The router also comes with an integrated FRAD (frame relay access device) to prepare traffic for frame relay services.

The second optimisation mechanism, dial-on-demand, operates on switched services. For example, if the ISDN BRI card is installed in the WAN slot, the router automatically dials up a connection when it detects queued-up data. When the transmission is complete, the router automatically tears down the connection. Managers can preconfigure the time lapse between the last bit of data traversing the link and the connection being closed.

The dial-on-demand feature also is useful when aggregating the ISDN BRI's two 64Kbps B Channels. Users can begin a transmission across one B Channel, and if traffic gets heavy on that link the router will dial up the second B Channel to alleviate the congestion. Again, the network manager can determine the channel capacity above which the second B Channel kicks in.

The Fast Lane

Express Queuing is ACC's proprietary prioritisation and congestion scheme, implemented in its entire router product line. Express Queuing prevents one type of traffic stream from dominating the network and preventing other types of traffic from going through.

It works by examining and setting up queues for different data streams on an application-by-application or session-by-session basis. A data stream is defined as a session from one end-station to another. The Express Queuing algorithm looks at the source and destination addresses of queued packets and other packet information to determine what type of session it is. This means that three IP sessions and five IPX sessions would be viewed as eight data streams rather than just two types of traffic.

Once the algorithm sorts out the data streams, it dynamically interleaves the traffic to ensure that each is given the appropriate amount of bandwidth. This is determined by the packet size of the particular data stream and the frequency of those packets as they enter the router's queues. As with most compression and congestion mechanisms, these optimisation features only work when the Danube is connected to another ACC router at the regional or central site.

Users can manage the Danube in either of two ways. The first is in-band, which implies that a link is up and running between the management console at the central site and the Danube at the branch office. The second is out-of-band, which requires a modem to be attached to the EIA-232 console port on the Danube to communicate with the network management console.

The Danube supports both SNMP SET and GET operations. The SET command allows net managers to set various parameters on the managed device. The GET operation allows the net manager to collect information from the device being managed to ensure that it is operating correctly.

Eric Birenbaum

PRODUCT SUMMARY

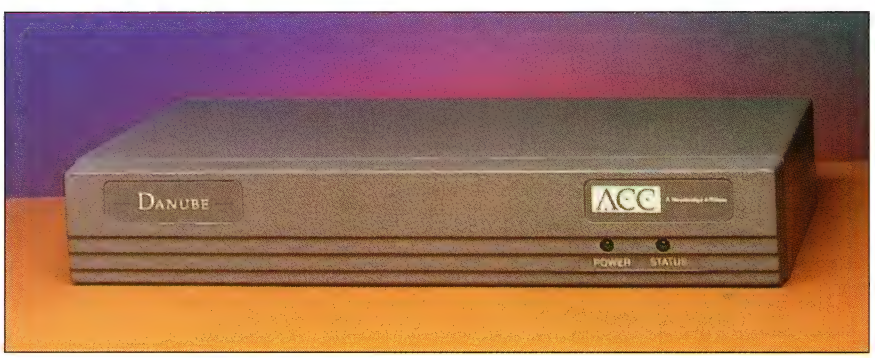
Name: Danube

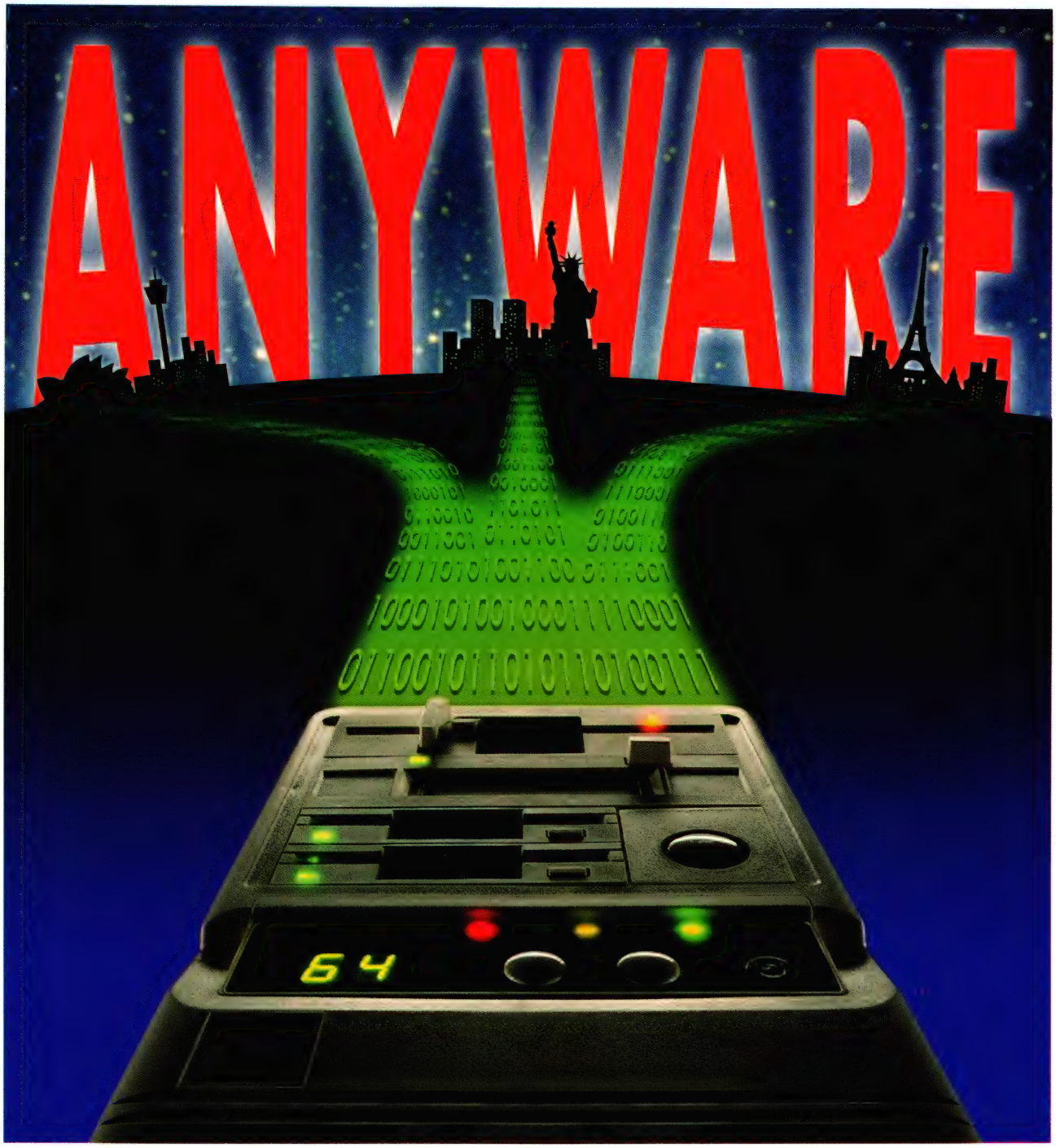
Description: Multiprotocol branch office router

Price: Around $4,260

Vendor: Advanced Computer Communications

Distributor: ADE Network Technology
Tel: (03) 543 2677; UB Networks
Tel: (03) 696 2006





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Reaching from the desktop to the enterprise, Big Blue's new family of ATM products brings sky-high prices down to earth.

When it comes to ATM, about the only things not in scarce supply are hype and high prices. At least until now: IBM is starting to make good on last year's announcement of its Broadband Network Services (BBNS), its comprehensive ATM architecture. Big Blue has just introduced a family of products that extends from the desktop to the backbone and brings ATM to market at a reasonable price.

On the LAN side, IBM offers the Turboways 25 ATM adaptor, Turboways 100 ATM adaptor, Turboways 8282 ATM workgroup concentrator, ATM LAN Link bridge, and LAN emulation software — a driver that runs on the adaptors and as an NLM (NetWare Loadable Module) on a NetWare server. On the enterprise side, the company has announced three models of the 2220 Nways broadband switch.

The glue holding IBM's ATM product family together is its Nways Broadband Switch Control Program, which manages connections through the network. Since the software handles both ATM cells and variable-length packets, BBNS can accommodate Token Ring, Ethernet, frame relay, and other legacy LANs and WANs. The program also takes care of bandwidth management, congestion control, and path switching. This, IBM says, makes it possible to establish the required quality of service for voice, video and data.

Fundamental to the new product line is IBM's new 'switch-on-a-chip' architecture developed by the company's famous Zurich Research Labs. This architecture features 16 input ports and 16 output ports operating in a non-blocking fashion. A single chip can drive over 8 gigabits of aggregate throughput and multiple chips can work together to produce higher throughput as required. And it doesn't stop there — William Johnson, IBM's General Manager, Networking Hardware Division, says that IBM has cranked each port up to 400Mbps in lab tests.

Johnson, who was in Australia recently for a series of customer seminars, says that cost effectiveness will be one of ATM's biggest drivers. He says that while in campus and LAN environments users will buy the technology for performance, in the wide area cost savings derived from more efficient use of bandwidth will play a major part in the technology's rollout.

PRODUCT SUMMARY

Description: Desktop-to-enterprise ATM products that implement IBM's Broadband Network Services (BBNS) architecture

Price: Nways switches (ex. tax): Model 300, $42,900; Model 500, $71,450; Model 501, $42,900. Nways switch control program: Model 300, $8,930, or $186/month; Model 500, $53,580, or $1,120/month. Turboways 25 adaptor, $870 ($847 for five or more); Turboways 100 adaptor $4,275 ($3,847 for five or more); Turboways ATM concentrator starts from $9,705. (Adaptor and concentrator prices include tax)

Vendor: IBM, Coonara Ave., West Pennant Hills, NSW 2125 Tel: 13 24 26

It's in the Cards

The Turboways 25 ATM adaptor is the key to making ATM affordable. Its $870 retail price is impressive, but that's just for starters. The 25Mbps card works with Categories 3, 4 and 5 STP (shielded twisted pair) and UTP (unshielded twisted pair) wiring, plugs into ISA bus PCs running DOS or Windows and furnishes up to 25.6Mbps of dedicated bandwidth. It allows for full-duplex communications and connects to the Turboways Workgroup Concentrator or directly to the Nways switch. The adaptor is shipping now.

IBM's 25Mbps take on ATM is not without controversy, however. The ATM Forum has decided against writing a specification for 25Mbps transport.

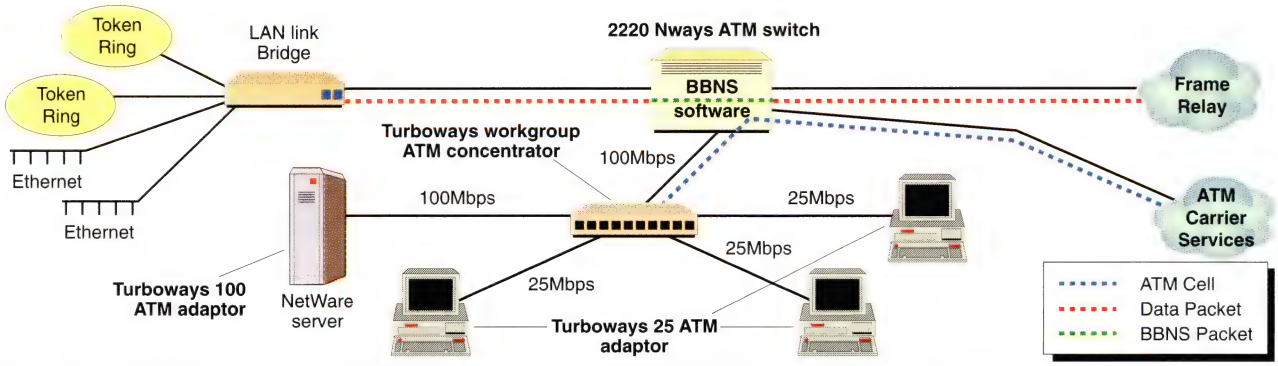
IBM also has the Turboways 100 ATM adaptor, which slots into Micro Channel Architecture PCs. Its main purpose is to establish full-duplex 100Mbps connections between Novell servers (running NetWare 3.12, 4.01, or higher) and the Turboways concentrator or the Nways switch.

The Turboways 8282 ATM Workgroup Concentrator connects up to 12 workstations via a 100Mbps link to a single port on the Nways switch. Tying PCs and servers into the concentrator in this way is far cheaper than using 12 separate ports on the switch itself. IBM also has announced the ATM LAN Link bridge, which makes it possible to connect Token Rings or Ethernets directly to the Nways switch, without ATM adaptors (see the figure). The bridge can handle up to four LANs and also can act as a local bridge between them.

The final piece of IBM's LAN product set is its LAN emulation software. This con-

IBM Puts the Pieces in Place For ATM

IBM's Broadband Network Services (BBNS) ATM architecture extends from the desktop to the backbone and includes adaptors, bridge, workgroup concentrator and broadband switches. The BBNS software, which runs in the switch control program, manages connections through the network and takes care of bandwidth management, congestion control, and path switching.



sists of drivers for DOS and Windows that run on the Turboways 25 and 100, and a so-called LAN emulation server, an NLM that resides in the NetWare server. The emulation software allows Token Ring applications to run unmodified on an ATM network. IBM is promising Ethernet in 1995.

For the enterprise, IBM features its 2220 Nways broadband switch. The Model 300 comes with 6 ports; the 500, with 10 ports; and the 501, with 16 ports. All three are shipping now, without ATM interfaces; ATM support will be added in the first half of 1995. IBM says that using variable-length packets inside the switch makes it easier to support legacy applications and transport mechanisms such as frame relay and SNA. When packets are being switched, the Nways works with PTM (packet transfer mode).

Quality Control

The BBNS software relies on three mechanisms to deliver various qualities of service: bandwidth reservation, congestion control, and path switching.

Bandwidth reservation defines two types of connections — reserved and non-reserved. Reserved connections, which receive higher priority, require network resources to be allocated when a session is set up. The software characterises connections according to three parameters — peak rate; mean rate (the average bandwidth used during the transmission); and mean duration, which is the same as burst length. In this way, BBNS differs from schemes that assign priorities based solely on peak transmission levels. Using its three parameters BBNS calculates the minimum bandwidth that can be assigned to a network connection while still ensuring that packet loss is within acceptable bounds. It also monitors the connections and can either bump up the bandwidth or lower it accordingly.

BBNS handles congestion control — specifically, call-admission control — by monitoring how much congestion is on the network and allowing no new connections to be established through the switch if it looks as if reserved connections may be affected. Once the congestion starts to clear, it will allow reserved connections to be set up first. If there's still bandwidth, non-reserved connections will then be made.

The third way of ensuring quality of service is via path switching. BBNS switches network connections in response to several different conditions. If the link goes down, the software moves sessions onto a new path. If the connection needs more bandwidth than is available on a particular path, BBNS will again switch paths. Finally, BBNS recognises different priority traffic and, if one connection is displaced by a higher-priority transmission, it will attempt to find a new path for the lower-priority traffic.

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WORKGROUP HUBS FEATURES TABLE

Company	Product	RJ45 Ports	BNC Port	Upgradeable to SNMP	AUI
Hewlett-Packard	EtherTwist Hub/8	8	Y	N	N
Cameo	**AH1000**	**12**	**Y**	**Y**	**Y (Two)**
Digital	Demon	5	N	N	N
Digital	DECrepeater 90T	12	N	N	N
Cabletron	MRXI-22	12	N	Y	N (Upgradeable)
Cabletron	MR9T 10BaseT Multi Port Repeater	9	N	N	N
NetWorth	EtherNext	9	N	N	N
IBM	8222 Workgroup Hub	6	N	N	Y
Adder	Hub-8	8	Y	N	Y
SMC	SMC 360 8TP	8	N	N	Y
SMC	SMC Elite 351 2TP	12	Y	Y	Y (two)
Asante	NetExtender Hub	4	N	Y	Y

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Castles in the Air: Spectrum Management

The *Radiocommunications Act 1993* is now over a year old, but as yet the only significant change is uncertainty about what lies ahead. Richard Pascoe looks at the issues facing the SMA.

The importance of the radiocommunications spectrum in modern communications is beyond question. Use of the spectrum plays an integral part in almost every communications system. That governments have recognised not only the importance of the radiocommunications spectrum but also its economic value is evidenced by the rush to change the allocation and regulation of the spectrum from an administrative function of government to an entrepreneurial, revenue raising, market-based system. In Australia this micro-economic reform of radiocommunications resulted in the *Radiocommunications Act 1993* ('Radcoms Act').

It is also clear that as demand for spectrum increases, so also will the complexity of valuing spectrum and ensuring sufficient allocation of spectrum between both prospective uses and users. Given the importance of communication systems generally and the integral role the radiocommunication spectrum plays in those systems, it is clear that the potential exists for the Spectrum Management Agency (SMA) to be one of the more influential and controversial areas of government policy administration in Australia over the next decade.

A Broad Spectrum of Issues

Some of the issues which need to be considered by the SMA in developing its plan for spectrum allocation include:

- The timing of spectrum availability for use in delivering particular technologies is and will continue to be critical for many investment and marketing decisions by industry. Already there are enquiries and expressions of interest in certain (and as yet unused) frequencies for which no useful advice can be given because at present there are no settled SMA guidelines or plans. Consequently, investment decisions are being delayed until such time as the regulatory environment is better established;
- The need to balance accommodation of existing and future technologies to provide a migratory path to future international allocations of spectrum. This path may be provided either through administrative procedures — for example, shorter term allocation of frequencies for specified uses with subsequent re-allocation through SMA competitive tender or auction processes — or via trading activities of spectrum licence holders. The best approach may vary for different parts of the spectrum.

The SMA will face many difficult decisions as to whether to allow the market to allocate frequency (with the possible consequence that incumbent users will not move to free up frequencies or that 'speculative' spectrum licensees may demand unrealistic prices for radio spectrum under those spectrum licences), or to attempt to keep control over the market through shorter term allocations.

In this context, it is worth looking at some of the SMA's powers to deal with and regulate spectrum use. Under the Act, the SMA has the power to prepare a spectrum plan and frequency band plans. Before preparing a spectrum plan or a frequency band plan, the SMA must make the plans available for public comment and invite interested parties to make representation about the draft plans.

At this stage, the SMA has not released for public comment a draft spectrum plan nor any draft frequency band plans, although it is possible that a draft spectrum plan will be issued for public comment before the end of this year. No doubt the process of preparing a draft spectrum plan and draft frequency band plan is complicated by the need to take into account the considerations outlined above.

The Minister then has the power, after consultation with the SMA, to give to the SMA a notice designating a specified part of the spectrum to be allocated by issuing spectrum licences. Those specified parts of the spectrum might include frequencies already in use under existing apparatus licences or may include unencumbered frequencies in the spectrum. If the bands specified by the Minister involve frequencies already in use under apparatus licences, the SMA is required to prepare a conversion plan to facilitate the conversion of existing apparatus licences to spectrum licences. If the bands designated by the Minister are unencumbered, then the SMA is required to prepare a marketing plan for those bands and then determine procedures for allocating spectrum licences within those previously unencumbered bands of the spectrum.

At each stage, the SMA may make draft plans available to the public and invite interested parties to make representations to the SMA about the draft plans. The SMA has indicated that it intends

to adopt a highly consultative approach at each stage of the allocation of spectrum. This will be particularly important when the SMA comes to determine the procedure for allocating spectrum licences (as opposed to converting existing apparatus licences into spectrum licences). For example, the SMA has the power to allocate spectrum licences by auction, tender or for a pre-determined price or a negotiated price.

The procedure adopted by the SMA for a particular band is most likely to depend primarily on the demand for those frequencies. If demand is low, then it is likely a pre-determined price would be the most attractive from the SMA's point of view. Conversely, if demand for a particular band of frequencies is high, then an auction or tender procedure would be most attractive. The SMA will also have to consider the length of time for which spectrum licences will be issued. Under the Radcoms Act, spectrum licences may be issued for up to ten years. It may be that a significant number of prospective spectrum licensees may prefer that the SMA either continue to grant short term apparatus licences or limited term spectrum licences for spectrum which may become subject to demand for use by emergent technologies, so as to ensure that frequency is available as and when those new technologies come to the market.

Suggested Criteria

Given that the SMA has stated that it wishes to adopt a highly consultative approach to determining the best method for both allocating spectrum licences and converting the existing apparatus licences into spectrum licences, what are some of the specific issues which the SMA will face?

- *Minimising cost to both the SMA and the prospective applicants:* There will be administration costs for the SMA in developing the regulations, issuing the licences and type approving the necessary equipment. There will also be costs in enforcing rights conferred on spectrum users, especially when dealing with interference. There will also be transaction costs for the prospective applicants in obtaining advice on the draft plans and procedures of the SMA, in instructing advisors, in consultations with the SMA, in preparing tenders and in general lobbying activities. Obviously, these costs need to be minimised, especially from an industry perspective, otherwise the whole premise of the Radcoms Act (which is, after all, to provide for the efficient allocation and use of the spectrum to maximise the overall public benefit) is negated;
- *Intermarket Linkages:* The SMA will need to determine whether the system proposed for allocating spectrum licences and converting apparatus licences is consistent with competition in downstream (spectrum using) markets. For example, does the proposed scheme adequately preclude the use of spectrum for eliminating competitors? Further, the SMA will need to ensure that the system proposed is consistent with price-based licence allocation procedures in other markets. For example, where a satellite pay TV operator or telecommunications carrier pays a substantial licence fee, it is hardly appropriate that it should also face price-based allocation of spectrum necessary to provide its service — unless of course, these prospective costs were factored into the bid process;
- *Relevance of non-priced based social equity priorities:* For example, there will need to be certain bands of the spectrum allocated for non-commercial uses. No doubt if the bands allocated for non-commercial uses turn out to be highly valuable, there will be increasing pressure from industry to open up those bands to full commercial spectrum licensing to allow for trading of those licences as proposed under the Act;
- *Speculative traders in spectrum:* Under the Radcoms Act, a spectrum licensee will not be obliged to use radio frequency. They may refuse to sub-licence or otherwise permit third party use of the frequency. Accordingly, licensees may be no more than brokers, adopting a speculative position in relation to bands which they consider likely to increase in value. The Government has not given to the SMA any powers analogous to, for example, Austel's powers to issue direction to telecommunications carriers in order to facilitate competitive provision of radio-based services. Indeed, competition is not stated as an object of the Radcoms Act. The possibility of spectrum licence speculators is a real one and they will be a phenomenon which the SMA will have to deal with. Could the SMA avoid these problems by imposing appropriate licence conditions — for example 'must carry' rules? Although appropriate conditions could theoretically be imposed by the SMA on the spectrum licence when issued, in practice it will be difficult (if not impossible) to anticipate the circumstances which may arise to justify the imposition of such conditions. For example, consider the position of a spectrum licensee which refuses to sub-licence frequency to its prospective competitor. The licensee may say that it anticipates that the band will be required for further expansion of its own services. Alternatively, it may say that having regard to developments in technology, it anticipates that a higher price may be derived for sub-licensing the band for other uses. These alternative uses may or may not be presently marketable — or indeed, generally accepted as feasible — at the time of the refusal to sublicence. The spectrum licensee may anticipate technological developments increasing the demand for the relevant frequencies later in the period of its licence. All of this would mean that a prospective competitor would face a very difficult task in obtaining relief in the face of such behaviour by a licensee;
- *Compulsory resumption of licenses:* The SMA has the power under the Act to resume spectrum licenses by compulsory process for subsequent reissue. However, this appears to be a blunt and expensive instrument that the SMA will, in all likelihood, be loath to exercise as the resumption price under the Act is the market price of the spectrum at the time of resumption.

The SMA will also need to ensure that the approach adopted will be likely to achieve public and commercial acceptance. Perceived equity and fairness will be a relevant but not the main factor in securing commercial acceptability. The SMA will need to accommodate existing already-licensed spectrum users to minimise uncertainty in the market and the likelihood of disruption to process. The importance of conversion plans and consultation with existing users will no doubt become clear and the SMA will need to take into account the substantial investments made by some existing apparatus licensees in network infrastructure.

Further, as the access to spectrum opens up under the spectrum licensing scheme, the SMA will need to ensure that the new system is easily understood by those it affects. This will be particularly important where new entrants are involved, as they may have little understanding of the process involved or the prior or standard administrative practice. Another dilemma facing the SMA will be to convince industry and the public that spectrum prices achieve economic efficiency objectives of the Radcoms Act and are not perceived as merely a new form of tax or that the Commonwealth, rather than the private sector, is capturing the premium for use of radio frequency spectrum.

The SMA will also need to be aware of the legal risk management issues to ensure that the process it adopts for allocating licences and converting apparatus licences are adequately documented and safe from legal challenge. No doubt this is part of the reason for the SMA's keenness to adopt its consultative approach.

Once the draft spectrum plan, frequency band plans, conversion and marketing plans are released for public comment, things should become clearer, but at present there are still significant practical difficulties in gaining access to spectrum, and all this before there is any talk of actually trading in spectrum licences, one of the main features of the Radcoms Act. There are interesting times ahead.

Richard Pascoe is a lawyer with Sydney technology law firm Gilbert & Tobin. This column sets out his personal views and not those of the firm or its clients.

The Intelligent Way to Boost Network Revenues

Bob Donaldson
Managing Director AIN, Bell Atlantic International

Bob Donaldson is Managing Director, Advanced Intelligent Networks, for Bell Atlantic International. From 1991 to mid-1993 he was based in Sydney as Managing Director of Bell Atlantic Australia and later of Pacific Star, the joint venture with Telecom Corp. of New Zealand. Donaldson has worked at Bell Atlantic for 24 years and has a Bachelor of Science in Marketing from the University of Maryland and a Master of Business Administration from George Washington University. While in Sydney to present a global overview of Intelligent Networks at a recent IIR conference, he spoke with Liz Fell at the offices of Pacific Star Communications.

AC: *What triggered the development of intelligent network [IN] technology in the US?*
Donaldson: The initial driver was the 'big ticket' services like the 800 Freephone, Calling Card and VPN [Virtual Private Networks]. Those 'killer services' were high revenue generators so all of the network operators wanted them.

AC: *Surely VPNs are essentially an operator strategy to replace private networks?*
Donaldson: That's right. Take Bell Atlantic's network. It's in an area of the US that is not growing at a great rate. The idea is to put more traffic over the network. That makes the network more efficient and drives more revenues with the same capital investment.

AC: *What revenue increases have you achieved?*
Donaldson: Our revenues have increased enormously. We're deriving $400-500 million a year from new IN-type services, including CLASS [Custom Local Area Signalling Services].

AC: *And those 'killer' services used intelligence outside the network switches?*
Donaldson: The early services such as 800 [008 in Australia] and Calling Card were based on an architecture developed by Bellcore known as IN-1. Prior to that, all the intelligence in the network had existed inside switches which had to understand the line and network features, how to transfer calls from one switch to another and how to route calls through the network. All of that logic was embedded in the network switches.

AC: *What is the benefit of developing intelligence outside the switches?*
Donaldson: Take the example of the 800 service which was offered prior to intelligent networks. The 800 numbers were fictitious so that a translation had to made in the switches before the call was routed to the real number. But every time an 800 number was added or changed, we had to go out to thousands of switches and change the translation. And because the 800 numbers were allocated by giving blocks to different operators, they were used inefficiently and therefore they ran out very quickly. So Bellcore and the US operating companies created a database for this service.

AC: *And Bellcore has since developed more sophisticated Advanced Intelligent Network [AIN] platforms?*
Donaldson: Yes. We had this initial platform but all it did was translate the 800 number to the real number so that the call could be routed through the network. Even though the logic was outside of the switches, we were limited in our ability to change the logic and provide enhancements. So Bellcore developed a new architecture and coined the term, Advanced Intelligent Network.

AC: *AT&T must have done well from 800 services too?*
Donaldson: The 800 service was dominated by AT&T initially. But now that there is number portability for 800 services that market share is eroding because MCI is able to take their customers and the numbers.

AC: *Would you characterise Bellcore's AIN architecture as a proprietary IN solution?*
Donaldson: Bellcore's AIN 0.0 and AIN 0.1 are US standards which are available to switch manufacturers and to operators. They require that the protocol be available in the switches, the Service Switching Points [SSPs] and in the AIN platform which is a Service Control Point [SCP].

AC: *Is it AIN in the US and IN everywhere else?*
Donaldson: Yes. The development of the IN internationally has been different because there was a lack of consistent standards. There was a homogeneous community of carriers and operators within the US which made it easier to develop a protocol and agree on standards for AIN.

AC: *What is happening beyond the US?*
Donaldson: It's very much like everything else in telephony. We've gone down different paths from a technical standpoint. There is a US standard and the rest of the world: T1 versus E1, and the ISDN is different too. It's unfortunate that it has evolved that way. Outside of the United States, there are operators with varying IN capabilities and there are standards bodies such as ETSI [the European Telecommunications Standards Institute] and the ITU-T. As a result, only now are IN standards beginning to be adopted.

AC: *And so the switch vendors have developed their own systems?*
Donaldson: Yes. They've developed proprietary solutions because internationally there was no protocol adopted and because it was in their best interest that there not be a standard. They've maintained strategic advantage by developing a proprietary solution because the operators now use their platform with their switch.

AC: *In your address to the IIR conference, you mentioned that Bell Atlantic has three different switch vendors.*

Donaldson: We made a purposeful step to go to three vendors for competitive reasons when in 1984 we had virtually one supplier, AT&T. We introduced Northern Telecom switches into the network and deployed them aggressively. Then after some years we realised that we had a duopoly of switch vendors and we weren't getting the competitive benefits that we were looking for. So while it complicated our lives immensely, we brought Siemens into the US market and spent a lot of time and effort helping them get started. That created the competition we were looking for.

AC: *Doesn't a multi-vendor switch environment create more problems?*
Donaldson: In Bell Atlantic's case, that was one for the drivers of the IN. The three different switch vendors would deliver new services in the switches at our request. But it could take three years to get a new service, and sometimes it didn't work like the other switch vendor's service when we got it. So we had the same network features three different ways in three different switches. By taking that feature outside of the switch and providing the capability on a separate IN platform, we could control how it worked.

AC: *Did the switch vendors see that as losing some control?*
Donaldson: I think that there was a perception on their part that INs were not beneficial because they would lose control of the software development on the switches. To the extent that the functionality and the software capability of the switches is removed or replaced by intelligent networks, the switches become more of a commodity. So the vendors were concerned that their strategic differentiation would be eroded. I believe that they shouldn't worry because IN capabilities allow new services to be delivered and these increase network traffic in potentially a stagnant market. Operators therefore will increase their throughput of calls and buy more switches.

AC: *Do the switch vendors agree with that argument?*
Donaldson: I think the jury is still out on whether they like the idea of INs. But they all are building their own IN platforms as a way to retain the control over the operators that they had in the past.

AC: *Are the GSM network switches any different?*
Donaldson: There is a lot more intelligence built into the GSM networks than in some past cellular systems. But if you want to increase the capability of the GSM system, you have to go back to the GSM switch provider and have them develop it for you. You're back into the old paradigm: wait for three years or wait till enough customers ask for it. The switch vendor is in control of the timetable. If you overlay IN capability on top of the GSM network, then you have the option of doing it yourself. So unless the network operator has complete control over the service development, they're always going to be dependent on the switch vendor.

AC: *And now IT companies are trying to break into the IN business too? Hewlett-Packard, for instance, was busy promoting its telecoms alliances at the IIR conference.*
Donaldson: All of the major suppliers of computer hardware are involved in intelligent networks in some way — the IBMs, Hewlett-Packards, Tandems. I don't see the switch vendors being replaced even though they have had varying degrees of success in building IN platforms.

> *"The IT vendors will have to align themselves with someone to be successful. You've got three different industries — the switch vendors, operators and IT vendors. I think the jury is out on who is best positioned, but I have my doubts on whether the IT industry can be successful ultimately in a market that is dominated by operators and switch vendors who understand how networks work."*

AC: *Do you expect to see more alliances between IT and switch vendors?*
Donaldson: The IT vendors will have to align themselves with someone to be successful. You've got three different industries — the switch vendors, operators and IT vendors. I think the jury is out on who is best positioned, but I have my doubts on whether the IT industry can be successful ultimately in a market that is dominated by operators and switch vendors who understand how networks work. It's a pretty tight knit community and it's a very complex business that takes quite a bit of experience.

AC: *Meanwhile operators, including Bell Atlantic, are trying to build these platforms themselves?*
Donaldson: Many have tried. Bell Atlantic certainly went down that path. If we had known how difficult it was going to be five years ago, we may not have embarked on it. We've had a few false starts, we've spent quite a bit of time and effort and we've come up with what is a very good product because of the relationship with Bellcore. But other operators have tried and not succeeded. I think it's a fair statement that virtually every operator has had a go.

AC: *So operators are both competing with and working with the switch and IT vendors?*
Donaldson: This is a bold new world where we are competitors and customers and collaborators at different points in time!

AC: *I understand you have had some success in selling the Service Creation Environment [SCE] platform developed by Bell Atlantic and Bellcore to Telia in Sweden?*
Donaldson: I believe that Telia has decided to become more multi-vendor in their approach to the network so they were looking for additional vendors . . .

AC: *Beyond Ericsson?*
Donaldson: Yes. On the IN side, they looked at a number of platforms and gave them a lot of technical scrutiny. So we were pleased that they decided to work with us. Last December we signed an agreement to deliver a European standards-based version of an IN platform as soon as the Ericsson switches have the standards-based SSP software, which looks like the fourth quarter next year.

AC: *Is that a real breakthrough in the European market?*
Donaldson: We feel it's a real breakthrough because Telia is very highly regarded by other operators.

AC: *What about operators down south like Telstra. Since you've been here, you've talked with Telstra and Optus. Are you trying to sell this platform to them?*
Donaldson: Obviously I have a vested interest in talking to them. We'd love to license the technology to either Telstra or Optus or both.

AC: *Would you do that through Pacific Star?*
Donaldson: Probably we would license it directly. But I'm sure Pacific Star would provide support to Bell Atlantic.

AC: *Given the regulatory environment here opens up in 1997 and Telstra will be privatised one day, would Bell Atlantic be interested in investment beyond Pacific Star?*
Donaldson: Bell Atlantic's strategy is to leverage its core competencies in the international market and to own and operate networks around the world. So whenever there is an opportunity to invest in a new market or in a new carrier or to joint venture, we always look at it very seriously.

AC: *Has the technology been adopted by Telecom Corporation of New Zealand in which your company is a part owner?*
Donaldson: Not yet.

AC: *How will AIN technology affect the CPE companies?*
Donaldson: I think the intelligence in the network will be coordinated with CPE to

provide true user friendly capability. For instance, the service creation capability that we have within the Bell Atlantic IN platform has a very user friendly interface. We expect in the future to have customers create their own services. But that won't happen until we have intelligent CPE that can communicate effectively with the IN in a 'standards-based' way. Then customers can sit down with their own PCs to create their own services.

AC: *You said at the conference that Bell Atlantic's aim was to be a transaction service business and to hand over service creation to customers. Can you elaborate on this?*
Donaldson: What I meant was that we're not as creative as our customers because they know what their problems are. So if we give them a tool kit and allow them to solve their own problems, they can create new services which will generate more traffic on our network and therefore more revenue for us. So we're looking at providing the network transport and charging for use of the network and for the use of the intelligence in the network.

But we don't have the technology yet to allow customers to completely create their own services. Today our customers sit down with our service creators and they jointly develop the new service.

AC: *How do you deal with interconnection of third party service providers?*
Donaldson: I think having third parties create services and then go out and market those services that run on our network is extremely beneficial for both. The big unknown is how the regulatory bodies will mandate interconnection. We would like to see that interface into the IN at a higher level, that is, at the front end of the Service Creation Environment [SCE] like we're doing at Bell Atlantic. We would work with third parties and allow them access to the SCE but we would still have the responsibility to validate those services and to make sure they don't create problems for the rest of the network.

AC: *That is from an operator perspective. Wouldn't competitive service providers approach it differently?*
Donaldson: Our competitors and others would like to have a free rein to do whatever they want. They would like to interface at the lowest elementary level of the network and just connect directly to the switches and to the AIN platform. That could be potentially disastrous for the operators and for the network itself.

AC: *Do you mean disastrous in terms of revenue loss?*
Donaldson: I'm not speaking of drawing off revenue. I'm speaking of creating harm to the network and potentially even blocking up the network. If somebody creates a service that generates a huge amount of network traffic to a single point, it could cause congestion.

AC: *How do you avoid network congestion?*
Donaldson: All operators have had that problem. Prior to INs, our network in the '80s was brought down in Washington by a Bruce Springsteen concert when some disc jockey advertised a number for two free tickets! Televoting, for example, generates a lot of calls. With the IN, these can be intercepted at the originating point and routed to the IN platform where there is an announcement: 'Dial 1 for the X' or 'Dial 2 for Y.' The network collects the information and there is no congestion. Televoting could be a 'killer' service in Australia because everyone is required to vote. What if you could vote electronically by telephone instead of having to return from vacation?

". . . we're not as creative as our customers because they know what their problems are. So if we give them a tool kit and allow them to solve their own problems, they can create new services which will generate more traffic on our network and therefore more revenue for us. So we're looking at providing the network transport and charging for use of the network and for the use of the intelligence in the network."

AC: *Will voice recognition technology make this sort of service easier?*
Donaldson: Bell Atlantic is currently testing an intelligent peripheral with voice recognition capability which is a part of the IN platform. The current voice prompt systems are not user friendly because you have to push all these buttons. What we'd like to do is have people talk through the phone rather than push buttons or dial codes. So we're going to be implementing voice recognition so you can pick up the phone and say 'Forward.' I think it is very close to being introduced.

AC: *Given you have spent some time in Australia, would you see the US offering any lessons on interconnection?*
Donaldson: We've seen a lot of things that happened in the US regulatory environment happen in a delayed reaction way internationally. For instance, the FCC's current position on number portability for the 800 service is being mandated in other places. I understand Hong Kong is talking about portability for all numbers. The introduction of number portability is going to cause INs to explode because they are the only way to provide portability efficiently.

AC: *How have customers responded to your company's Personal Communications Services (PCS) trial in the US, where they have a single personal number for wireless and wireline?*
Donaldson: It's a very small trial, but we got a lot of feedback from the customers. What we did learn was that there is a very good demand for a single number service. Bell Atlantic's objective is to have a network that is transparent to customers so that they are contactable wherever they are.

AC: *When will we see the widespread introduction of single personal number services?*
Donaldson: You can't do it without an IN.

AC: *Is that far into the future?*
Donaldson: That's far away before everybody has number portability.

AC: *Given there is customer demand for a single personal number and portability, why is this so far away?*
Donaldson: There are several things that are required. One is to have a modern ubiquitous network with digital switches. Bell Atlantic has a ubiquitous network that has the same capability in West Virginia as in downtown Washington. The second is that we have a very advanced SS7 signalling network so virtually 100% of our switches are connected. It's mandatory to have a good SS7 signalling network for IN because that's how you pass the intelligence around the network. Those are the two prerequisites. The third is to provide the IN capacity and most operators are still putting their toes in the water. They're buying a single SCP, putting a single service on it and seeing how that works. Then they expand to another service. This is happening slowly because they're not very sure of what the future holds.

AC: *Surely in this customer-driven environment, operators would respond if customers wanted personal numbers?*
Donaldson: All customers would like to have more capability than they have now, even our customers! But there are varying degrees of competition among operators around the world and varying degrees of incentive for them to modernise their networks. Those that are still primarily a monopoly and government-owned have less incentive to modernise as quickly as those that have a high degree of competition.

AC: *Telstra, of course, is still government-owned but subject to competition.*
Donaldson: Telstra has been at the forefront in adopting new technologies. But it has a lot of work to do to modernise the network and to some extent that will slow down the intro-

duction of new technologies because the network is not uniform. They have a lot of older switches.

AC: *How does that impact on introducing new IN services?*
Donaldson: It makes it more difficult because in the near term all that Telstra can offer is an overlay service for a lot of people and that limits the functionality. Optus has the advantage of buying digital switches and therefore being able to provide more uniform services. But they've got a big job ahead of them to build up the network.

AC: *Someone from Telstra looked at me as if I were mad when I asked for a timeframe on personal numbers or Universal Personal Telecommunications [UPT] services. Will these require a massive investment?*
Donaldson: That's the real issue. It's a very large capital investment. So most operators are asking: 'Where is the payoff? Why should I invest a huge amount of money in buying this IN and modernising my SS7 network?' They're not convinced that there's a pot of gold at the end. But my view is that regulatory issues will mandate the implementation of INs regardless of revenue concerns. Number portability is a case in point. Right now we have a number portability requirement in the US for the 800 service. We've just introduced 500 numbers which are the personal numbers that people would have for life. But those numbers are not being implemented in an IN way.

AC: *Why not?*
Donaldson: Various 500 numbers have been allocated to the carriers and operators. What will happen is that the numbers will probably run out within the next year or two.

AC: *That suggests a repeat of the 800 situation you mentioned.*
Donaldson: Yes. They will have to go to an IN solution to expand the 500 numbers available. That will speed up the installation of IN platforms. And those platforms, which have to be there for regulatory reasons, will be available for new services. All of a sudden you'll see carriers running around justifying the revenues they're going to get because they've put in these new IN platforms!

AC: *Surely personal numbers could be a 'killer' service?*
Donaldson: Those are the kind of killer applications that will probably be mandated from a regulatory standpoint. What I see on the horizon is a lot of killer applications such as area number calling.

". . . most operators are asking: 'Where is the payoff? Why should I invest a huge amount of money in buying this IN and modernising my SS7 network?' They're not convinced that there's a pot of gold at the end. But my view is that regulatory issues will mandate the implementation of INs regardless of revenue concerns."

AC: *This is the Pizza Hut example, the One3 number here?*
Donaldson: Yes. That was implemented by Telstra before everywhere else, though not with an IN platform. It was done by some intelligence on their part to create the service. Pepsico, the owner of Pizza Hut, has been pursuing that service elsewhere but it would have cost us more to implement than they were willing to pay. With IN technology, it's very cheap. Using our platform, US West has introduced the service this year and we're about to do the same in our region. That service alone is expected to generate millions of dollars for each of the operators.

AC: *What is the path from intelligent narrowband voice to intelligent broadband multimedia services?*
Donaldson: I think we have to apply the lessons we learn from solving the problems with existing networks. Broadband networks today are in their infancy. What we have are the beginnings of ATM switches that have a lot of capability but not a lot of intelligence at this point. In the voice world, because of years of software development and all the features being loaded into the voice switches, we had these huge software platforms and a lot of the switch capacity was being used up with all these features just to support all of that software.

AC: *There appears to be an enormous push towards ATM.*
Donaldson: Network operators and telephony people tend to be technologists and get people very excited. But broadband switches today are really dumb: they don't have a lot of functionality. Why make all the mistakes with broadband that we made with voice switches? My view is that the way we'll go forward with broadband is to keep the switches relatively dumb but provide IN overlay for all the intelligence and operator control. Bell Atlantic has funded some research with Bellcore on applying our IN platform to the broadband platform. We're looking at how we would develop that into a broadband network control.

AC: *In your IIR speech, you mentioned a need to learn from ISDN. What is the lesson there?*
Donaldson: ISDN was a very neat technology that was ahead of the market. The demand is now picking up as we finally figure out how to use it. We have to make sure INs don't follow the same pattern. Local area networks are a good example of how the technology followed. Everybody had PCs and the problem that arose was how to communicate between them. So LANs were developed and refined, and they still need more refinement, but they have developed to the point where they solved the problem. ISDN is solving some problems today, but long after it was introduced as a technology.

Liz Fell is a freelance journalist based in Paddington (NSW).

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Tom Amos

TAPping the Future

With the emergence of a government-sponsored Telecommunications Advisory Panel (TAP) committee to review and consider the post-1997 framework for competition, it would seem appropriate to consider not only how the existing suppliers will cope but the potential for success new entrants may have in introducing new services. There has been already an evolution from monopoly to duopoly and then to an open market over a relatively short period. The benefits of increased competition have already started to be realised, although the full benefit may not be available until after the turn of the century. The rules being developed today for that time to come are therefore critical, just as they were when the duopoly was established as the first step. Consideration and use of all technologies, particularly the introduction of new and future technologies, should be not precluded on anything but cost effective or safety grounds.

To put some perspective on the problem of a future level playing field, consider the utilisation of radio spectrum and the introduction of new services via this medium. Extensive investments have been made by the existing carriers, and some measure of protection of this commitment will be necessary.

By the end of the century it is expected that there will be several new basic service providers offering new services to the public — services no doubt including wireless PABXs and LANs, Centrex-like services, data and video, and the common carrier services of wireless local loop, mobile and PCS. The technology evolution is in full swing, using radio spectrum, antennas and towers in ever more interesting and challenging ways. Does the new environment allow the new market entrants to enjoy the access and construction arrangements of the existing suppliers, or do you change the rules, as has effectively occurred with the recent issue of a new planning code? This represents a potential problem. The introduction of a new planning code for radio-based telecommunications services on top of the Act may seem a little ho hum in 1994, but there has been great community interest in both the proliferation of the radio towers that now dot the landscape, and in the emotive issue of irradiation. It is clear that the number of towers, even without new operators, will continue to grow with the requirement for new services.

The current three radio-based carriers all enjoyed, until the new planning code, the powers that Telecom, and previously the PMG, had enjoyed for over 90 years — the right of immunity, resumption and property entry to establish telecommunication services. All that has changed with the introduction by the Minister of an overriding code to the powers granted under the *Telecommunications Act*.

It can be argued that sharing of infrastructure between competing mobile communication carriers has been ineffective, and that the new code will force such sharing now and in the future. No chance, given the competitive nature of the evolving business!

The Government's original intention was not to have unnecessary duplication of infrastructure, as this was in the interest of neither itself nor the community in general. The penalty for duplication is usually higher user costs, and this not only applies to the infrastructure but also to the efficiency of use of all the attendant resources.

New technology for personal communications, LANs and even the humble cordless home telephone is now coming on-stream. The introduction of an overriding planning code that reduces the powers of all future service carriers in the area of tower provision may be less than effective when viewed on an overall basis. After all, the majority of infrastructure has already been deployed in the higher density areas. The impact of new planning restriction now will do more to harm the potential new entrants in the opening marketplace than to encourage sharing or innovative infrastructure use. This may force new entrants to utilise existing infrastructure/facilities where they can be made commercially available, or to enter tariff-punitive roaming agreements where such arrangements are not possible.

The old powers were once needed to facilitate speedy delivery of a basic telephone network across Australia. But today their relevance in a commercial application world does need to be questioned, given that the basis for such powers in the first place was the national interest. I could be forgiven for thinking that competitive enhanced services were in the national interest . . . but I would be in the definite minority.

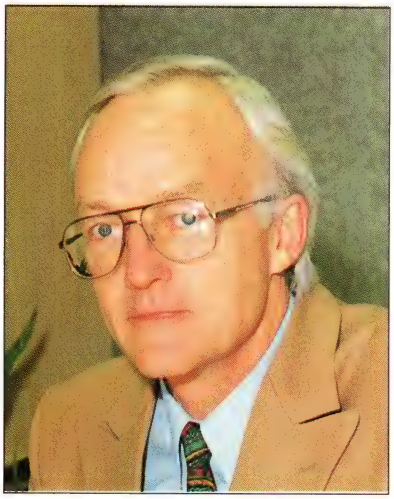
There is already precedent for continuation of the powers to all who wish to provide services. When the 1991 *Telecommunications Act* was being debated and considered the relevance of extending the powers was questioned, given the general community concern in local planning and building. It was conceded then that the advantage that was transferred to the incumbent by not extending the powers to all other suppliers would significantly disadvantage the new entrants. A few years on what has changed? There are now more incumbents and a new code that enshrines the past will make it very difficult for the post-1997 operators.

The benefit to the user of the open provision of new services could be a more cost-related structure of services, with the attraction of tariffs determined by the marketplace rather than by a limited exclusive supply market. To this end no new powers should be granted to new providers and the existing powers should lapse for all, so that all participants are on an equal footing and abide by community standards.

As to the past — well, there is a real tilt problem evident already. Some form of counterbalance may need to be considered in much the same way as it was in 1991, possibly taking the form of access to existing sites developed under the old regime on an open and fair basis. After all, sharing of sites and infrastructure was one of the planks upon which the Government originally opened the market.

The time for change to the rules was 1991. The missed opportunity then could severely impact the chances for new wireless carriers unless there is now correction of the supply side distortion.

Tom Amos is a partner with telecommunications consulting engineers Amos Aked Swift.



Dr Ockert van Zyl

Telecoms Reform: Let's Look at the Big Picture

I recently attended an international conference in Sydney which endeavoured to draw some conclusions about the changing nature of the telecommunications industry here and overseas. My conclusion at the end of the five days was that there are no simple answers and no complete models to help us predict the best way to move forward. But the many discussions served to focus my thinking about national telecommunications policy and the industry's role in generating wealth and employment.

To understand my perspective, I should say that the company I work for was founded by two brothers, Werner von Siemens (in Germany and Russia, principally) and William Siemens (in England and other Commonwealth countries). The brothers represent a true case history of technology and economic growth. They were both innovators and creators of wealth, and by the late 1800s were global players in pursuing that first international information roadway — the telegraph network. They were exposed, from the start, to a competitive environment. The telecommunication equipment supply industry has been in this competitive environment for as long as most of us can remember. So my remarks should be seen as coming from someone who is a firm believer in competition which is moderated by a forward-looking flexible legislative framework.

The moderating influences that you will notice on any simple competitive approach stem from the complex and, in my view, little understood inter-relationships of local, national and global telecommunications; manufacturing's metamorphosis into a service industry; the impact of intellectual property (IP) and research and development policy; interaction between training, retraining and education, and national and regional employment; and investment policies.

What I see as the central issue in the debate about telecommunications and its role in the local, national and the global economy is this: we are dealing with a global product; telecommunications, by its very nature, crosses boundaries and is one of the most globally pervasive economic activities. But in every single country the industry still has to position itself in terms of local and national economic priorities. We can build a global information highway between Canberra and Washington, but on both sides of the Atlantic we battle with the political realities of a communication technology import/export balance; we communicate weekly with Munich by videoconference, but in a recent White Paper the European Union, while accepting an 'open' market policy, stresses the maintenance within the Union of a position in basic technology as one of the three cornerstones of its information technology strategy. Let us therefore be careful about this global industry — the technology reach may be global; the underlying national issues are very local.

This brings me to my second issue: that economists' modelling of the industry confirms my intuitive response that infrastructure investment has a positive impact on the economy. What is less clearly articulated is that it is necessary to consider the telecommunications industry in Australia and many other economies not only as an infrastructure investment, but as a secondary industry with a manufacturing component.

In infrastructure mode the future of telecommunications points in one direction only: increased productivity, better service and prices to delight the customers, spectacular new applications, and increasing unemployment at a local level. In its manufacturing mode, telecommunications represents a value-added industry generating intellectual property, creating wealth and more jobs.

A national, competitive model not sensitive to these issues may reduce the costs of telecommunication services in an economy while undermining the growth in the telecommunications manufacturing sector. Arguing that stimulation of infrastructure development will create growth and job creation in other sectors, while true, does not correct this fundamental imbalance.

There is another basic issue in the process of wealth creation and job creation that needs to be considered. This is the seemingly universal progress from manufacturing to services as the major employer in mature economies. The associated effects are equally well established. The manufacturing sector has ready access to both domestic and export markets, whereas the service industry is, by nature, more inward looking. We can manage an international network from a small corporate centre — but the job opportunities are in the target markets. Associated with the change in the industry both in terms of technology and with the shift towards services, the skill set requirements of the industry also changes. Thus a new and rapid demand is made on the education system for more people with skill in the physical sciences, marketing, and organisation and management of telecommunication networks and services.

In this context it's worth considering the issue of multi-skilling which has become intertwined with the basic education process. Although multi-skilling is an important factor in the evolution of industry productivity and should therefore be supported in this context, I believe there is a cross-over barrier between skilled and professional employment which is difficult to overcome. Siemens' research over thirty years confirms this. Although employment has increased, the numbers in semi-skilled and skilled employment has declined consistently.

The key to the longer-term problem of meeting the demand for skilled staff in and for the technology industries, particularly telecommunications, must surely lie with a number of connected policies, of which education is the first stage. Bearing in mind that the industry will need people with education in the physical sciences, the most recent national surveys paint a disturbing picture of how many senior students are interested in these subjects. The number of qualified teachers is also a worry and a separate, though limited, survey of Australian managers suggests they need considerable education about science, too!

That aside, in developing an overall telecommunication industry strategy there is another industry behaviour issue which requires consideration. I call this the 'bounce' concept.

A first-bounce enterprise, whether a manufacturer, a service provider or an operator, is defined as an enterprise located in its home market and 'owning' the full skill-set required for its operation, in particular, the intellectual property which forms the basis of its long-term survival. Every post-industrial economy has a larger or smaller number of first-bounce enterprises. These are mostly trans-nationals in their home markets, the national network operators (the majority still government-owned) and the smaller, indigenous businesses (manufacturers and service providers) with international aspirations. First-bounce enterprises move from their domestic focus to an export position through competitive pressure in their home markets and go, on first bounce, into the world market where they compete with other international and local enterprises.

The advantages of first-bounce is clear. The enterprise carries out its right, as owner of its intellectual property to attack any market which meets its business plans and aims. It requires no permission (within a given legal and regulatory framework) to do so. The first-bounce enterprise establishes a presence on the new market, where it addresses domestic market needs. But it also experiences the legitimate demands of the host country for local manufacture and exports out of the new host country.

This leads to second-bounce enterprises: the offspring of the transnationals, the carriers with offshore operations and other derivative enterprises. The second-bounce enterprises obviously have a much more restricted access to the world market, not only meeting the other international and local players, but also running into their owners and shareholders, who are in first-bounce mode. The model is clear, but is the message? Without first-bounce telecommunications — and other — enterprises, any economy has only a restricted scope to address the import-export balance for telecommunications and other products and services.

The emphasis of first-bounce is on an enterprise having access to or ownership of intellectual property which is unique or at least superior to the intellectual property available within the enterprise anywhere in the world, and not only on the actual ownership of the enterprise. The local offspring of a transnational, for example, may have a skill-set or intellectual property which places it in a position of competitive advantage within the global group for the associated products — effectively a first-bounce company. We have many examples of such transnationals competing effectively in the region and turning Australia into an exporter of high technology telecommunications products and services.

A critical issue in the first-bounce-second-bounce model is the ownership of the national carriers, particularly with the shift from the manufacturing employment to services employment. No industrialised national economy can sustain a long-term process of wealth creation and job maintenance in telecommunications without the ownership of at least one first-bounce telecommunications carrier and a number of first-bounce and quasi first-bounce telecommunications manufacturers. This places my view on the location of ownership of Telecom plainly on the record.

Australia's Competitive Strengths

The three major areas of activity are R&D, manufacture, and construction and operations. In the R&D area there is an established level of competitive advantage in the Australian telecommunications industry. I am not suggesting that this is unique. There are a number of countries with comparable strengths, but in terms of productive engineering dollar per hour this is a real asset. In my opinion the wealth creation and job creation opportunities in the R&D sector are relatively small. In the manufacturing sector a competitive ability exists for specialised flexible manufacture, but globally jobs are moved to low-cost production markets of which Australia is not one.

In the construction and operations area, a high degree of competitive strength exists with substantial wealth creation but only limited job creation opportunities. This industry model leads me to an important conclusion. That is, that only by vertical integration, from R&D through manufacture to construction and operation can a balance be obtained between wealth creation and jobs. And since these sectors represent different industry players, this vertical integration can only be obtained by multi-disciplinary and commercial alliances. These strengths will not emerge in Australia if competition on an economic purist's playing field is applied, as it is at present. No one sector can alone survive the natural progression in a deregulated competitive global market. In my view the future for the industry lies in international co-operation for reasons of the size of investment opportunities; risk sharing in view of short innovation cycles; and for reasons of market knowledge.

In tandem with that co-operation between carriers I expect to see a larger role for multi-disciplinary, research/manufacturing/operating alliances. Co-operation between global players in the equipment supply sector of the industry is a fairly well-established process — and the success rate, or the lack of it, should give potential partners a great deal to think about: co-operation functions best among complementary organisations where synergies apply; relationships of pure market convenience seldom do so.

(As an aside, the Western industrial world is now littered with the shells of manufacturing companies which outsourced close to their core business for short-term gain and ended up losing their most valuable assets — their research staff, their manufacturing know-how and their market knowledge — to their suppliers).

At this point in time the single, most pressing need is for Australia's national policy makers to clearly articulate the desired outcomes of their telecommunication policies. We need to review our national objectives. What are the outputs that we are aiming for? Is it industry sustainability, wealth creation and jobs, balance of trade benefits or a budget surplus? What we should not find acceptable are statements only on the means to be used, such as lowering tariffs, open trade, free competition, deregulation, privatisation, or what could be termed moral high ground positions. Those are means to ends. If we do not know the aims, those processes can result in lose-lose scenarios, ruinous domestic outcomes and fewer jobs.

So, having our first wave of telecommunication deregulation behind us and with the 1997 review of the *Telecommunications Act* ahead, and despite the GATT requirements (or perhaps because of them) this is a good time to stand back and re-examine at the bigger picture. I think we must recognise that telecommunications is a unique industry with some inconsistencies:

- Global in its operation; local in its economic effect.
- Infrastructure entails costs to business; at the same time a wealth creating industry.
- Secondary (manufacturing) industry sector; and a large tertiary (service) industry sector.
- Technology pushed; but often market pulled.
- Creator of jobs and wealth in some markets; displacer of jobs in others.

On this basis, the industry in total has to be based upon the widest possible degree of open, international access, however:

- Local necessities in terms of economic and social requirements must be considered within this broader framework;
- Employment in the telecommunications industry even in 'first bounce' remains under pressure;
- Any country hoping to maintain a long-term competitive telecommunications industry (as distinct from having a well-established telecommunications infrastructure) must maintain its 'first bounce' industry capability, in particular the IP to cover all aspects of the business process (R&D, production and construction and operation).

Only through multi-disciplinary partnerships, covering this full range, can the promised international telecommunications network also lead to nationally acceptable solutions which lead to greater wealth and new and sustainable employment.

Dr Ockert van Zyl is General Manager, Telecommunications and Manufacturing, for Siemens Ltd. He is based in Melbourne.

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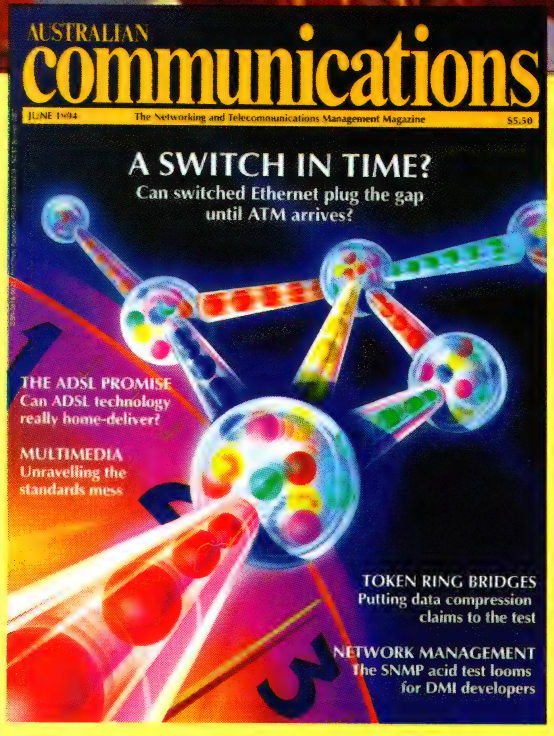

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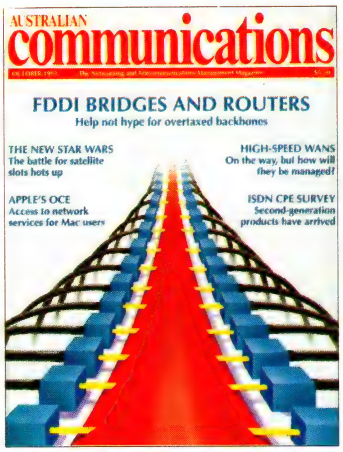

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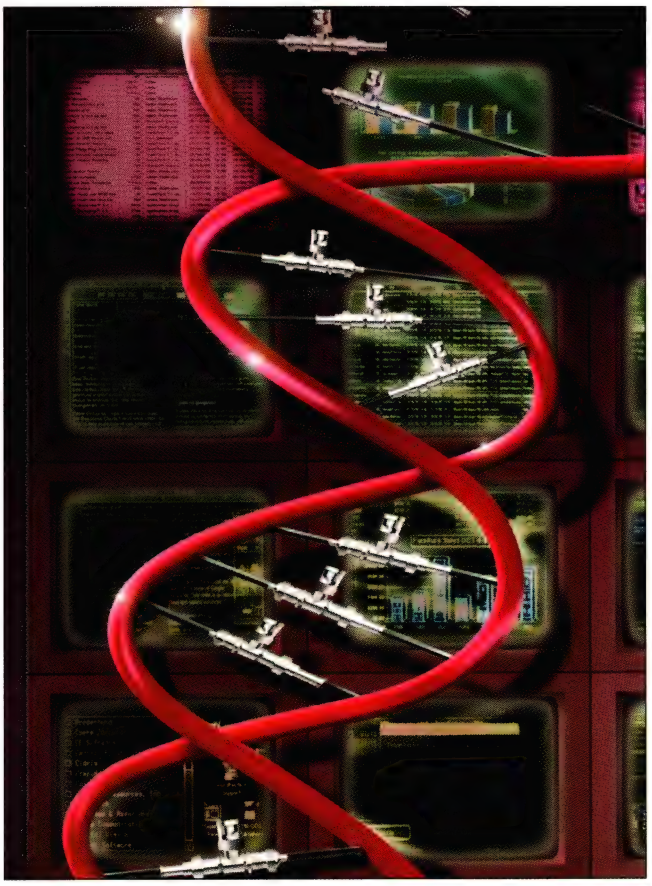
Downsizing: Overcoming Client/Server Chaos

Many organisations are making the move to client/server systems, but at what price? The loss of the kind of integrated tools found in mainframe systems can add up to a mess for network managers.

The downsizing buzz saw now ripping through corporate infrastructures is powered by one guiding principle: organisations will become more responsive (read profitable) if key business processes are decentralised and distributed. In terms of management, that means cutting back or even dismantling oversized bureaucracies to make way for smaller, more dynamic groups. Centralised IS, with its closely guarded and largely inaccessible resources, was among the first entities to feel the blade of change.

LAN-based client/server systems are a big part of the downsizing revolution. The client/server model offers an almost ideal match for the information needs of a distributed and downsized enterprise. In particular, client/server solves two major problems that have vexed mainframe users for years: it removes restrictions on information access by putting data on the desktop, where departmental users get things done, and it breaks the ever-growing application backlog by enabling users to create simple programs in a fraction of the time (and expense) that mainframe development requires.

As important as the benefits of client/server are, organisations are finding that decentralised information technology has one potentially crippling side-effect. Client/server applications address the needs of users *within* corporate departments and business units, but they can have a negative effect on the flow of information *between* departments. Mainframe-monopolised networks may have been slow, static, and generally unresponsive to individual users, but at least they offered a global view of data. And in the dynamic and competitive global economy, unrestricted flow of information between corporate departments will be the key to responsiveness.



Another Revolution?

Few outside Armonk, New York, and maybe Maynard, Massachusetts, would advocate a return to the days when proprietary large systems dominated corporate networks. But good business re-engineering doesn't end with simple downsizing. What's needed are applications that integrate distributed resources into an enterprise-wide framework without sacrificing the core strengths of client/server computing. To make enterprise integration work, network planners must come to grips with interprogram communications techniques and how these methods can be combined in a way that makes the most sense for a given network.

For instance, the synchronous interprogram communications model employed by many client/server systems does not lend itself to cross-departmental applications. As software architects and network designers begin to grapple with cross-departmental concerns, one reality is sinking in: enterprise-wide integration of distributed applications won't be fully realised in this century.

The Enterprise Landscape

Enterprise integration relies on inter-program communications techniques that must meet a unique set of criteria. Integrative applications can scale to very large proportions, but size is by no means the only metric. Enterprise integration typically unites

diverse heterogeneous platforms and protocols in both distributed and centralised environments — IBM System/370 MVS, DEC VAX VMS, Unix, OS/2, Windows, Apple Macintosh, and so on. In many cases, enterprise integration must contend with constricted WAN connections, nomadic (i.e. mobile) users and applications, and complex multi-tier topologies.

Enterprise applications involve either interactive user-initiated operations or unattended application-to-application exchanges. Because they often cross departmental lines, both cases involve an element of back-end-to-back-end communications that traverse the WAN.

A large number of very different software development products are now being touted as enterprise-level resources, including PC-based front-end tools with graphical user interfaces (GUIs), SQL (Structured Query Language) databases, document management systems, store-and-forward mail engines, and message-passing application program interfaces (APIs), among others.

Vendor-inspired labels often blur the distinctions further: 'enterprise' is the marketing buzzword *du jour*, and sellers of client/server software haven't been shy about wedging it into their product names. For instance, Soft-Switch calls its store-and-forward mail switch Enterprise Message Exchange, while US vendor Powersoft Corp. bills its high-end client/server GUI tool set Powerbuilder Enterprise. Not to be outhyped, Novell has given the latest incarnation of its Message-Handling Service the conspicuous monicker Global MHS.

Some of the terminology that's used to describe product functions also can muddy the waters. The term 'messaging' is used to describe two very different types of program-to-program dialogues. Store-and-forward messaging (such as X.400 and e-mail services) uses a communications model that is quite distinct from that of message-passing middleware APIs. And the terms 'synchronous' and 'asynchronous' refer to modes of interprogram communications at the application level; as such, they are not related to line disciplines at the link level. For instance, asynchronous interprogram dialogues can take place over synchronous CSU/DSU (channel/data service unit) links, while synchronous interprogram dialogues can be carried by dial-up async lines.

Communications Paradigms

One of the best ways to get a handle on so-called enterprise products is to determine which communications model they adhere to. The most well known models — batch transfer and terminal-screen communications — will continue to be used indefinitely in distributed environments. But aside from these old favourites, there are three interprogram communications models available to developers of distributed applications: synchronous request/response, asynchronous messaging passing, and store-and-forward messaging. Each of these techniques provides a different degree of coupling between application partners.

Synchronous request/response: Most of today's client/server applications are based on synchronous SQL or remote procedure call (RPC)-style calls that provide interactive program-to-program communications between networked machines. Synchronous applications involve tightly coupled clients and servers that interact in real time or near real time.

Vendors that offer development tools with synchronous request/response capabilities include Oracle and Gupta Corporation, among many others. The Distributed Computing Environment (DCE) from the Open Software Foundation is largely based on tightly coupled request/response interactions between application partners. Client/server network operating systems like NetWare, and SQL database products also use this approach.

Asynchronous message passing: Under this approach, diverse applications exchange messages asynchronously — that is, without the need for real-time synchronisation of application partners. Messages can carry any type of payload, whether it be transactional data or documents, graphics, forms, and images, in both client/server and peer-to-peer architectures.

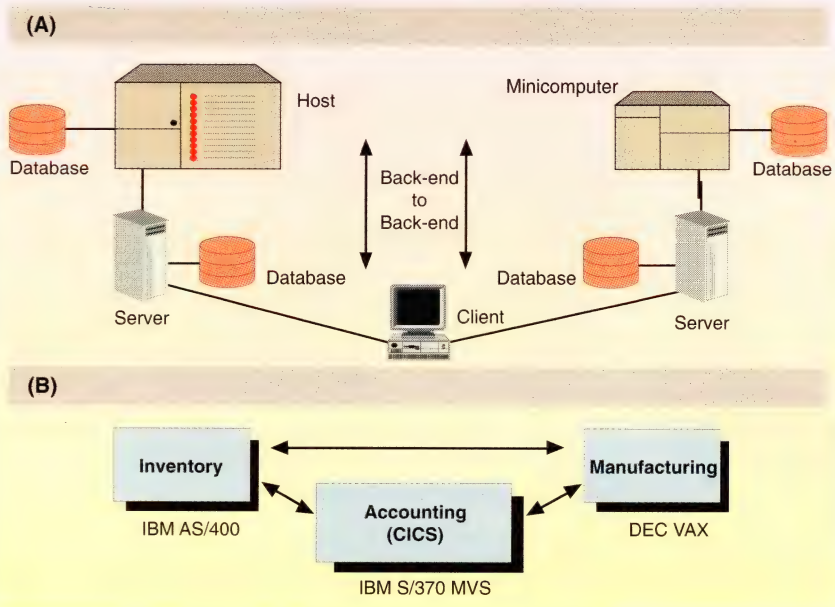
Message-passing services use a model based on flexible coupling that can support fast or slow dialogues, depending on such factors as available bandwidth, application backlogs, network connections, and the like. Message-passing APIs are relatively new and generally are not yet found outside a few niche industries.

Store-and-forward messaging: APIs that follow this model give applications access to store-and-forward e-mail systems that are available in all commercial host, minicomputer, and LAN environments. Store-and-forward systems carry messages between users or between programs, thus enabling a wide range of document management, forms automation, and workflow applications that span the enterprise. Store-and-forward messaging backbones work asynchronously; they deliver messages in a few minutes or a few hours, depending on design criteria and network size.

Each of these three interprogram communications models can be deployed by any of the major development tools including GUI- based PC tools, conventional third and fourth-generation languages (3GLs and 4GLs), and computer-aided software engineering (CASE) products (see the table on page 67). The models are not tied to a particular low-level network protocol; for instance, request/response PRCs could use TCP/IP or NetWare IPX for transport, while message passing APIs could run over Logical Unit 6.2 (LU6.2), TCP/IP, or NetBIOS.

Figure 1: Applications Over the Enterprise

Enterprise applications involve either user-initiated multi-tier client/server exchanges (a) or unattended exchanges among various large systems (b). Both architectures involve some form of back-end-to-back-end communications that traverse WAN links.



Synchronous Client/Server

Programs written with popular GUI tools typically use tightly synchronised dialogues between application partners. These request/response methods are an extension of the function call, a fundamental part of all

An Enterprise Software Sampler

VENDOR	PRODUCTS	PRODUCT TYPES
Digital Equipment Corporation (02) 561 5252	DECmessageQ	Message-passing middleware
IBM 13 24 26	Message Queuing Interface	Message-passing middleware
Lotus Development (02) 350 7700	VIM; Lotus Communications Server	Mail server and store-and-forward messaging API
Microsoft Corporation (02) 870 2200	Enterprise Mail Server; MAPI	Mail server and store-and-forward messaging API
Novell (02) 925 3000	NetWare Global MHS	Mail server and store-and-forward messaging API
Oracle Corporation (02) 971 1000	Oracle 7	SQL and client/server products; SQL databases
Soft-Switch Software Distribution International (02) 906 8600	Enterprise Message Exchange (EMX)	Store-and-forward message switching and translation

procedural programming environments (like C, Pascal, PL/1, Basic, and the like). A function call allows the main body of a program to invoke reusable modules of programming code that do specific jobs. For instance, a program could call a function that writes data to the screen, reads a database record, or sends text to a printer.

In the 1980s, as Unix workstations, minicomputers, and PCs became LAN-connected, the function-call paradigm was extended across the network — giving rise to the remote procedure call (RPC) model. In Unix, DEC, and similar environments, RPC tools emerged that could distribute the function calls of a single program to network-connected computers. Using RPCs, developers could write a monolithic program on one machine that would later be split into client and server portions by the RPC tools. The tools deal with network protocols and communications, so little or no network knowledge is required on the part of the programmer. In a parallel development, developers of file server technology (such as Microsoft and Novell) extended DOS function calls across the LAN to enable PC clients to access shared DOS files.

SQL offers another prime example of tightly coupled request/response interactions. Although SQL can be used in a wide range of settings, including IBM DB2 and DEC RDB database environments, as client/server computing gained in popularity, SQL was adapted to the RPC model. Client-server computing gained in popularity, SQL was adapted to the RPC model. Client/server SQL allows clients to make request/response calls to database servers that execute relational queries and updates. Since client/server SQL uses the same request/response paradigm as RPC, vendors of SQL databases — such as Oracle and Sybase — can support RPC fairly seamlessly with their database tools.

In general, the RPC-style model downplays any network effects by assuming that a reliable LAN is always present to provide a high-speed connection between clients and servers. According to the RPC-style request/response model, the client sends a request to a server and expects an immediate response.

Typically, RPC and SQL-based client/server programs require the client to hold all processing until a response is returned from the server — a process known as a 'blocking' operation. Blocked operations prevent client processes from running in parallel with server processes. Instead, the two sides must operate in alternating lock-step: the client waits on the server, and then the server waits on the client. In synchronous GUI-based software environments, the client machine is effectively locked up until the server completes its processing and returns a response through the network (sometimes referred to as GUI lockup).

The request/response model splits a logically monolithic program into client and server portions, in the process setting up a blocking, connection-dependent relationship between client and server processes. For this reason, blocked, connection-dependent operations are classified as synchronous interprogram communications because of the timing dependency between both sides of the application. In synchronous interactions, if the network connection fails, application processing is suspended. (Asynchronous dialogues decouple application processing from network operations.) Synchronous programs require that uninterrupted network sessions be maintained between application partners — not always an easy task in complex enterprise environments.

Synchronous interprogram communications are no problem in tightly coupled LAN environments, where client/server connections are always active and servers are relatively responsive. But when WAN links, multi-tier topologies, or nomadic applications enter into the picture, network delays effectively freeze application processing for extended periods of time, in some cases terminating sessions and hanging applications. Under these conditions, highly independent applications lose their independence if coupled synchronously.

Some makers of client/server development tools have tried to overcome the limitations of synchronous development models by making use of the multithreaded capabilities of certain operating systems (such as OSF/1, OS/2, and Solaris).

Theoretically, multithreading can help circumvent the limitations of the synchronous request/response model by introducing multitasking to the paradigm.

Unfortunately, at this point threads are not available on many platforms, and even when they are, they introduce great complexity into the application development process. The threaded RPC model is not inherently reliable or straightforward, so the programmer has to pay much attention to low-level application internals, including interthread communications, resource contention, and corruption of common data. This effort is not required in asynchronous messaging environments, where automatic error recovery and guaranteed delivery are provided transparently by the messaging subsystem.

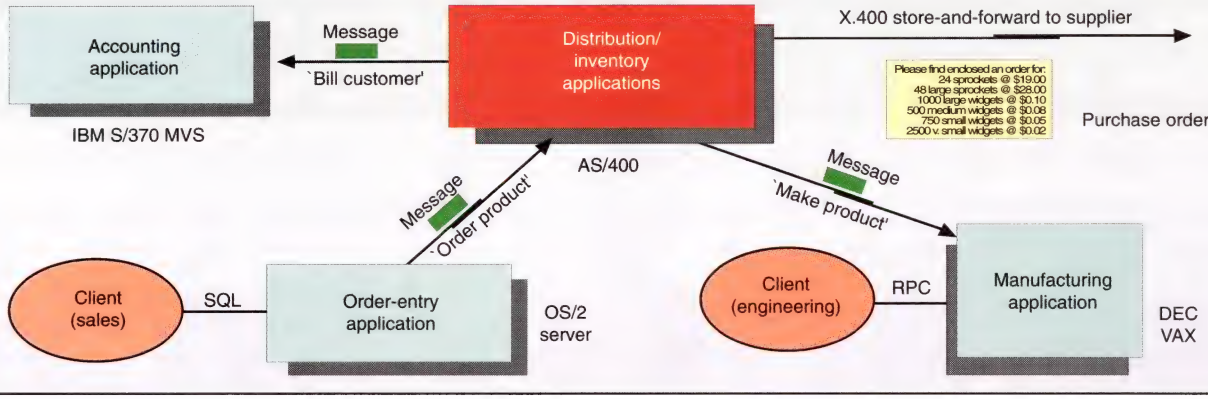
Asynchronous Message Pass

A major alternative to the synchronous client/server approach is the message-passing model. Message passing doesn't require local and remote applications to block each other synchronously. When software queues are added to message-passing services, applications can send and receive requests via a queuing system that resides on the sender, the receiver, or both. After a message is placed in the queue, an application can go about its processing chores asynchronously, without stopping and waiting for a response to come back through the network. The queuing system takes care of delivery, retry, and confirmation, adapting automatically to server backlogs and WAN outages without imposing blocking or connection dependence on application partners.

When a message-passing client needs information from multiple servers, it sends out multiple asynchronous messages that servers can process whenever network and backlog conditions allow. When one ser-

Figure 2: Three Models, One Network

A complete enterprise-integration framework will involve aspects of all three interprogram communications models, with each approach deployed where it fits best. For instance, tightly coupled synchronous client-server transactions will dominate local computing, with asynchronous messaging and store-and-forward services operating on the enterprise level.



ver's WAN link fails, it doesn't necessarily stop the entire transaction, as is typically the case in synchronous interactions. Programs based on asynchronous message passing don't require that persistent network sessions be maintained between all participating partners. Because application partners are independent but coordinated, message passing exploits the natural parallelism of the network.

Not all applications need this type of functionality, but in complex enterprise environments other techniques fall short. For instance, when a synchronous program is scaled to enterprise proportions, it tries to behave like a huge monolithic application that spans many different platforms and WAN links synchronously — a network manager's nightmare. To support synchronous applications at the enterprise level, network designers would have to provide LAN-like bandwidth throughout the enterprise. Obviously, that's not about to happen anytime soon in most large networks.

The asynchronous message-passing model also is a good fit for nomadic applications like wireless networking. A wireless packet-switching network can have end-to-end transit times of several seconds or more, with typical throughputs under 10Kbps — characteristics that make it unsuitable for synchronous client/server applications. The optimal model for this kind of high-latency, low-bandwidth, and relatively unreliable environment is asynchronous queuing or store-and-forward services that automatically adapt to delays and line failures.

Reality Check

Although asynchronous message-passing API service theoretically are ideal for mission-critical enterprise integration, current messaging products are by no means complete in terms of functionality and platform support. In their zeal for total heterogeneous scope, vendors tend to exaggerate their coverage. Some still don't offer native host support, and those packages that do run on hosts don't necessarily accommodate all the major host operating environments.

Some products suffer an even more basic deficiency: they are not set up to handle message queuing. Such products can do no more than simply pass messages between machines in real time, which means they are inappropriate for large enterprise networks. APIs should provide the option of asynchronous queues, ideally on both sending and receiving sides of the network. Another key feature to look for is the option to automatically write queues to disk, a way of guarding against software and hardware failures.

Only the most advanced messaging products now offer guaranteed delivery of messages with disk queues, transaction journalling, and several kinds of end-to-end message confirmation. Most importantly, message-passing API vendors need to raise the level of abstraction in their program interfaces. The currently prevalent low-level APIs must be enhanced with higher-level 4GL, CASE, and GUI application builders — as SQL and RPC vendors have already done.

Store-and-Forward APIs

The third communications model, store-and-forward messaging, is increasingly represented by vendors as an effective way to build enterprise-wide distributed applications involving deferred delivery of documents, forms, files, and images. Store-and-forward messaging is highly asynchronous — transaction times are measured in minutes. In comparison, synchronous request/response transactions take milliseconds to complete.

Many enterprise-class applications can tolerate store-and-forward's relatively lengthy completion times, however. Some enterprises are even using store-and-forward messaging systems with production database to deliver front-end forms and back-end reports. There are stories of large corporate store-and-forward systems (over 20,000 desktop machines) that deliver messages to all points of the enterprise in an average of 10 to 15 minutes. Smaller mail systems can have considerably better end-to-end transit times.

Store-and-forward messaging systems are widely available on host and minicomputer platforms, but vendors of LAN-based e-mail software are best positioned for enterprise connectivity. Offerings from Lotus, Microsoft, and Novell run on desktop machines and connect to large systems through gateways.

When applications use store-and-forward messaging backbones, they generally are given a mailbox address and a local post-office server (just like end-users). The application addresses a message, appends any attachments, and submits the message to the messaging API. The local mail server periodically forwards messages to remote servers, where the messages are picked up by target applications.

On the backbone, store-and-forward messaging services follow the X.400 model, using message transfer agents (MTAs) to provide intermediate routing and forwarding services for mail clients. LAN e-mail products typically integrate MTAs into a server-based post-office application.

The store-and-forward messaging backbones usually accommodate all types of attachments, including binary files, images, multimedia files, and so on. Because they have built-in distribution-list services, store-and-forward systems are ideal for broadcasting or multicasting files to large numbers of users.

Until recently, store-and-forward messaging servers were passive file-sharing devices that left most of the processing to client machines. But newer store-and-forward servers handle many of the directory

Continued on page 74

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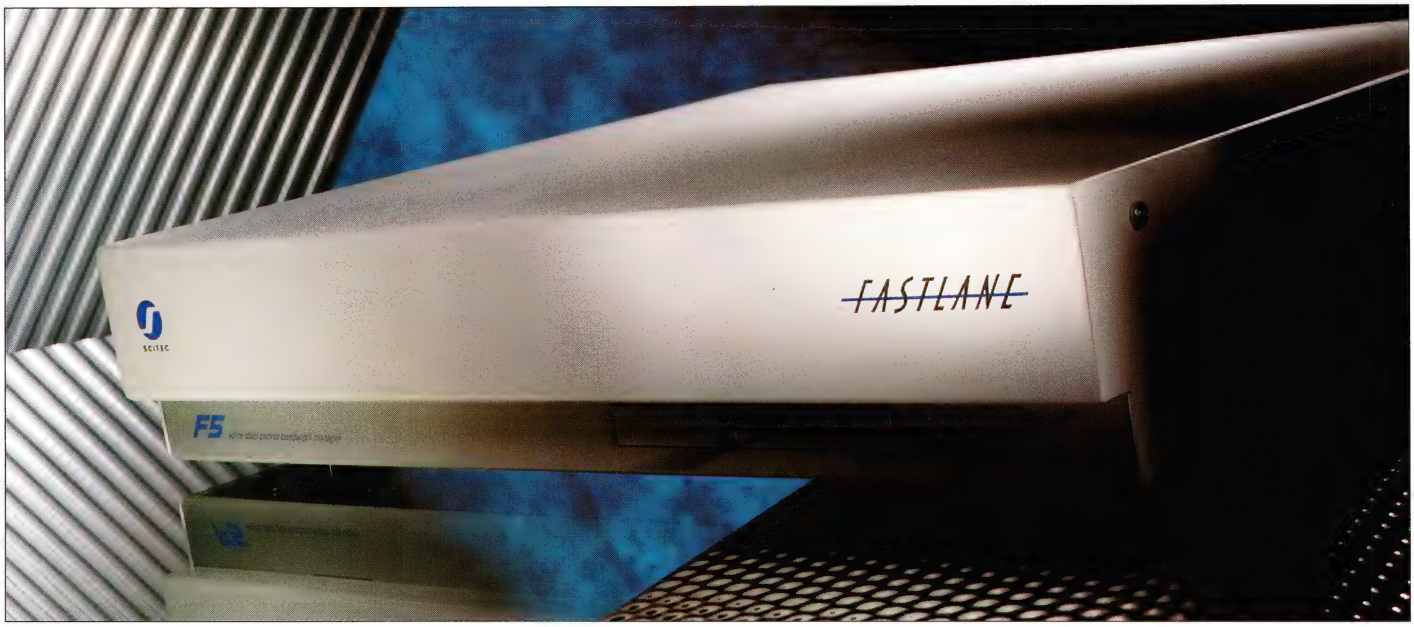

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Performance Management — The Client/Server Challenge

Corporations are charging ahead with their plans for client/server computing, scrapping the big iron in favour of distributed networks. The once-mighty glass house is starting to look like a garage sale: everything must go — single-vendor networks, dumb terminals, costly cabling, proprietary hardware, burdensome software licences, complicated maintenance agreements, and effective performance management tools.

But as most net managers know — and client/server champions are beginning to figure out — the same tools that made mainframes the very model of reliability for over two decades are pretty much Missing In Action for distributed networks.

True, there are tools out there that can furnish some of this information. Most Unix workstations come with utilities that supply data about a single system — forcing net managers to visit each and every node they need to check up on. Management frameworks like HP OpenView and NetView/6000 typically keep tabs on network inventory — CPU type, memory size, resident applications — but can't deliver detailed performance data. Even emerging systems management frameworks, like CA-Unicenter/Star from Computer Associates, are geared more to administrative tasks like backup, printer management, and job scheduling. Simply said, none of the products now available can gather in-depth performance data about multiple systems and display it on a central console.

Meanwhile, framework vendors like HP, IBM, Openvision, and Tivoli Systems are getting serious about delivering sophisticated performance management (see the table on page 72). And a new class of performance management applications are now starting to hit the street.

Getting a handle on tools to manage distributed systems means matching an organisation's needs to available products. This invariably involves compromise: performance management for client/server computing is still very much a matter of filling in the blanks. For example, while most applications furnish a consistent interface to several versions of Unix on the server, they don't yet monitor the performance of attached clients.

The place to begin is by choosing the appropriate package, which means understanding the differences between on-line monitors and off-line analysis tools. It's also critical to be clear about exactly what sort of performance data an application can supply, as well as the operating systems it tracks. Further, net managers need to know the degree to which a particular product can automatically deal with problems as they crop up. Simulation is another important consideration: Some packages perform 'what-if' analyses on data gathered from the live network; others give users a way to build models of network activity from scratch. As always, how efficiently an application uses bandwidth and system resources are critical concerns.

Generally, performance management packages fall into two categories: on-line monitors and off-line analysis tools. On-line monitors run as applications on a server and gather information in real time. They're very similar to the programs that have been in place on mainframes for over 20 years. They can track operating system response times, CPU cycles, I/O activity, memory use, and other indicators of how effectively server software and hardware are working together. Tools run the gamut from HP's Glanceplus, which offers snapshots of how an individual system is performing, to US-based Landmark's Probe/net, which delivers detailed performance information for multiple systems. Most products also offer some event reporting and the ability to take automatic action in response to certain conditions.

Off-line tools also have their roots in the mainframe world. Like on-line monitors, they gather data in real time, but instead of sounding alarms or responding automatically to trouble they store samples taken at user-specified intervals in order to compare performance statistics over time and identify deteriorating conditions, overloaded applications, and reduced efficiency. HP's Performance Collection Software (PCS) is one of the premier off-line packages.

But the line between the two types of products is beginning to blur. On-line monitors like Ecotools from Compuware's Ecosystems Group, Perfview from HP, and Performance Series for Unix from Landmark all capture data across time intervals for later analysis.

Not Ready for Prime Time?

Although on-line and off-line packages duplicate many of the functions found on mainframe monitors, network managers who expect to see the same quality of performance information will be disappointed. Vendors are only starting to address in-depth performance management for client/server systems and have many obstacles to overcome.

For example, detailed performance data can only be obtained if the software trying to gather it has hooks into the operating systems and applications at the heart of the corporate network. But even in today's world of so-called open systems, vendors are understandably reluctant to part with trade secrets about how their systems really work. All too often, developers of performance management tools are forced to reverse-engineer operating system kernels or, as one vendor confided, hire away employees.

The alternative is to rely on the same rudimentary monitoring utilities that vendors like HP, IBM, and Sun Microsystems bundle with the versions of Unix shipped with their servers. Despite their usefulness as basic sources of data on individual platforms, these utilities have a long list of drawbacks. They're old; they weren't designed to monitor more than one system; and they usually don't sample data over time, save it at specific intervals, or make it available to other systems.

This situation makes it very tough to determine what sort of data a package can pull from a server. Further, just because a vendor can monitor hundreds of variables for one version of Unix is no reason to believe it can do the same with every version. HP, for instance, admits the amount of information its PCS tracks for HP/UX currently exceeds what it can gather from SunOS and AIX, even though all three are supported by HP's application.

Despite this drawback HP's PCS is recognised as a leading source of Unix metrics. In fact, Legent has incorporated it as part of its Paramount Performance Manager, a Unix application that consolidates performance information from multiple servers and workstations.

Outside Looking In

Trying to cope with all the performance management issues associated with Unix servers has forced many vendors to put plans for Windows, Windows NT, OS/2 and DOS on the back burner. Legent alone supports Windows; Cabletron supports Windows NT; Tivoli and Candle promise Windows NT by the end of the year.

As vendors turn their attention to these other operating systems, though, they'll encounter equally daunting problems. Neither DOS nor Windows comes with native management utilities. And add-on packages for these systems have no links to Unix. It's pretty much the same story for OS/2. While IBM's LAN NetView analyses the performance of OS/2 LAN servers and clients, the information gathered can't be shared with IBM's Unix management tools. Microsoft bundles a Performance Monitor program with Windows NT and Windows NT Advanced Server that keeps tabs on over 400 conditions related to CPU and memory use, amount of time ap-

Performance Management — The Client/Server Challenge (Cont.)

Selected On-Line Performance Monitoring Packages

VENDOR	PRODUCT	TYPE	MONITORED SYSTEMS	ALARMS/ HISTORICAL TREND ANALYSIS/ AUTOMATION	CONSOLE	CONSOLE-TO-AGENT COMMUNICATIONS
Boole & Babbage (03) 820 3811	Sysnet Performance Monitor	On-line monitoring	AIX, HP/UX, SunOS, Solaris	Yes/Yes/Yes; also via Command/ Post	Motif under AIX, HP/UX, Solaris	RPCs over TCP/IP
Bull HN Information Systems (03) 246 4400	Integrated System Management (ISM) Performance	On-line monitoring, off-line analysis	AIX, Bull DPX/2, SCO Unix	Yes/Yes/Yes	Motif under AIX, SCO Unix	SNMP or CMIP over TCP/IP or OSI
Cabletron Systems (02) 950 5900	Maestrovision for Spectrum	On-line monitoring	AIX, HP/UX, SunOS, Solaris, Ultrix, SCO Unix, Silicon Graphics Irix, Windows NT	Yes/Yes/Yes	Spectrum console under AIX, Silicon Graphics Irix, SunOS	Cabletron External Protocol Interface
Candle Corp. (02) 954 1500	Omegamon for Unix	On-line monitoring	AIX, HP/UX, SunOS	Yes/Yes/1Q95 via Availability Command Centre	OS/2 Presentation Manager attached to an IBM main frame under MVS	RPCs over TCP/IP, UDP, SNA
Compuware Corp. Executive Computing (02) 816 1177	Ecotools	On-line monitoring	AIX, HP/UX, SunOS, Solaris, Amdahl UTS, Pyramid DC/OSx, SCO Unix, Sequent Dynix/PTX	Yes/Yes/Yes	Motif under HP/UX, SunOS, Solaris, X terminal on Sequent computers	RPCs, SNMP over TCP/IP
Digital Equipment Corp. (02) 561 5252	Polycenter Performance Solution Family for Unix Systems	On-line monitoring	AIX, HP/UX, SunOS, DEC OSF/1, Ultrix	Yes/Yes*/Yes	Motif under DEC OSF/1, Ultrix	RPCs over TCP/IP
	Polycenter Fullsail	On-line monitoring	AIX, HP/UX, DEC OSF/1, SunOS, Ultrix	Yes/Yes*/Yes	Motif under DEC OSF/1, Ultrix	RPCs over TCP/IP
	DEC Polycenter Capacity Planner	Off-line analysis	DEC Open VMS, Ultrix, OSF/1	Yes/No/No	Motif under DEC OpenVMS, Ultrix, OSF/1	NFS, FTP, file copies in Unix
	DBA Workcenter	On-line monitoring	AIX, HP/UX, SunOS, DEC OpenVMS, DEC OSF/1, Sequent Dynix/PTX	Yes/Yes/Yes	Motif under DEC OpenVMS, DEC VAX, DEC OSF/1	RPCs over TCP/IP
Hewlett-Packard 13 13 47	HP Performance Collection Software (PCS)	Off-line analysis for one system	AIX, HP/UX, SunOS, Solaris	Yes/Yes/Yes	No separate console; PCS has a command-line interface; PerfRX offers a graphical interface for PCS data on a single system	PerfRX uses NFS to access PCS information
	HP Perfview	On-line monitoring	AIX, UP/UX, SunOS, Solaris	Yes/Yes/Yes	Motif or OpenView under AIX, HP/UX, SunOS, Solaris	Berkeley Unix sockets over TCP/IP
	HP Glanceplus	On-line snapshots of one system	AIX, HP/UX, SunOS	Yes/Yes; for one day/Yes	No separate console; Motif under AIX, HP/UX, SunOS	None
	HP Openview Operationscenter	On-line monitoring	AIX, HP/UX, SunOS, Solaris, HP MPE/iX	Yes/No/Yes	Motif under HP/UX	RPCs over TCP/IP
IBM 13 24 26	Systems Monitor/6000	On-line monitoring	AIX, HP/UX, SunOS, NCR Unix	Yes/Yes/Yes	Motif under AIX, HP/UX, Solaris, NCR Unix	SNMP over TCP/IP
	IBM AIX Performance Toolbox/6000	On-line monitoring	AIX, HP/UX, SunOS	Yes/Yes/Yes	Motif under AIX, X Windows	SNMP over TCP/IP
Legent Corp. (02) 325 5000	Paramount Performance Manager	On-line monitoring	AIX, HP/UX, SunOS, Solaris, Windows	Yes/Yes, via HP PCS/Yes	HP/UX	RPCs or proprietary middleware over TCP/IP
Tivoli Systems Unixpac (02) 953 8366	Tivoli/Sentry 2.0	On-line monitoring	AIX, HP/UX, SunOS, Solaris, Data General SVR4, NCR Unix, Motorola SVR4	Yes/Yes/Yes	Motif under AIX, HP/UX, SunOS, Solaris, Motorola SVR4, Data General SVR4; NCR Unix	Object calls in TCP/IP

* Via DEC Polycenter Capacity Planner

OTHER MONITORED APPLICATIONS	LINKS TO OTHER NETWORK MANAGEMENT FRAMEWORKS
None	HP OpenView
Bull BOS/TP transaction-processing monitor, Oracle database	Any SNMP or CMIP management station
None	Cabletron Spectrum
None	None
Oracle, Sybase databases	Ecosystems Ecosphere, HP OpenView, IBM NetView/6000
None	DEC Polycenter Manager on NetView
None	DEC Polycenter Manager on NetView
None	DEC Polycenter Manager on NetView
DEC, Oracle, Informix, Ingres, Sybase databases	DEC Polycenter Manager on NetView
None	None
None	HP OpenView, HP OpenView Operationscenter
None	HP OpenView
Any application that can issue performance information	HP OpenView for Unix or Windows
None	IBM NetView/6000
None	Any SNMP management station
No	Legent Cross Platform Environment (XPE); HP OpenView
Any application compatible with monitored OSs	Via APIs

plications spend in the sever kernel, delays associated with user input, and so forth. Once again, though, there are no direct links between Performance Monitor and Unix, even if Microsoft says there's nothing to stop a developer from creating them.

Automatic Pilot

But there's more to client/server computing than operating systems. Vendors also are starting to address performance management for applications like database management and transaction processing.

Given that many vendors are still struggling with basic data collection issues, features like event reporting and automation may sound like they belong on a wish list. The truth is, a few products already offer them — Compuware's Ecotools and HP's Perfview filter events and automatically respond to problems, generally by sending an e-mail message, activating a pager, or generating a Unix file.

And more elaborate automation is in the works. Candle says it will roll out its OS/2-based Availability Command Centre early in 1995. The product gathers and displays performance information from Candle Omegamon monitoring packages running under AIX, HP/UX, SunOS, and Windows NT. The Command Centre's point-and-click interface lets users at a central site take on-the-fly readings of remote activity and institute corrective actions simply by selecting icons. If a server is running out of memory, say, files can be moved to backup with the click of a mouse.

One For All

Some vendors are competing for customer dollars by offering an entire suite of performance management tools that encompass on-line monitors and off-line analysis tools. HP is a good example. As noted, its Performance Collection Software gathers data from servers running under AIX, HP/UX, SunOS, and Sun Solaris and stores it for future analysis. PCS is sold as an off-line performance analysis tool for tracking activity on individual operating systems. It comes with a command line interface but no central console. Optionally, users may purchase a tool called PerfRX to obtain a graphical interface to PCS data. To view on-line performance information across multiple platforms, net managers must add HP's Perfview, a Unix application that simultaneously monitors AIX, HP/UX, SunOS, and Sun Solaris from a central console, Perfview is integrated into HP's OpenView network and systems management applications, including HP Operationscenter, a mid-level manager than gathers system alerts from workstations under HP/UX and SunOS.

The Effectiveness Factor

Key to choosing performance management products is network efficiency. In most cases, on-line and off-line applications follow the agent/management paradigm. Agent software is placed on every server and workstation in the network in order to keep track of their activities. These agents report selectively to a central console.

The agent/manager model has worked well for network and systems management. But performance management poses special problems. For one thing, agents need to be more intelligent simply because they have to process more information. It's a lot more complicated to sift through I/O activity, say, than it is to report whether an SNMP-compliant bridge is up and running.

For another, performance management data can be so extensive that it quickly consumes bandwidth and system resources. Most vendors agree it's much more efficient to process performance data locally and send findings to the central console. HP, for instance, uses Perfview only to display the results of performance management readings that take place entirely on local systems equipped with PCS or Perfview agents.

Further, many vendors increasingly believe that standard management protocols like SNMP just can't handle the enormous amount of complex data amassed by performance management packages. And special techniques are needed if an SNMP console is gong to address multiple agents at one time. For instance, it's vital to ensure the mechanism for performance monitoring isn't going to be intrusive to the system itself, or performance problems will be aggravated.

Instead of sustaining continuous SNMP traffic between agents and the central console, Compuware's Ecotools product uses RPCs (remote procedure calls) to send information. An SNMP gateway is deployed to exchange information with other applications.

Meanwhile IBM and Legent are working on a joint project (code-named Mercury) to develop software that supports multiple intelligent SNMP agents in distributed networks and links to management frameworks like NetView/6000. Reportedly, Legent is providing the technology for configuring and installing the agents, while IBM will supply the data collection mechanisms and connections between agents and console.

Mary Jander is network management and new products Editor for Data Communications magazine.

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and storage management chores previously left to clients. These active servers require that an independent application runs on the server (as with NetWare Loadable Modules). Active servers offer enhanced security and performance, increasing the likelihood that store-and-forward backbones will be suitable for enterprise-integration applications.

All of the major suppliers of store-and-forward messaging backbones have built gateways to external store-and-forward systems, and encourage third parties to build them. For end-user mail, these gateways represent a practical way to communicate with diverse messaging systems like IBM Profs, the Unix-based simple mail transfer protocol (SMTP), X.400, Oracle Office, AS/400, and DEC's All-in-One. But for interprogram communications, store-and-forward messaging gateways are not useful unless applications on both sides of the gateway can interface with a somewhat equivalent store-and-forward API.

Unlike synchronous client/server tools, store-and-forward messaging services are naturally suited to nomadic applications. Nomadic users often need only occasional access to the enterprise network for transferring forms, reports, documents, or database updates. Lotus, Microsoft, and Novell all have included support for remote and/or mobile users in their store-and-forward messaging architectures. But although they all claim to offer enterprise services, the three are taking vastly different tacks in the way they present their services.

Messaging with Microsoft

Microsoft's yet-to-be-released Enterprise Mail Server (EMS) is a Windows NT application that supports e-mail clients on PCs running under NT, Windows, or Microsoft's forthcoming Chicago operating environment, as well as on Macs or Unix machines. EMS (which actually is a Microsoft code name that may change later this year) will provide an active post office for Microsoft Mail clients and a platform for a slew of coming third-party mail, fax, image, and document management applications. The full program interface to EMS will be available on Windows platforms and is referred to as MAPI (Messaging Application Programming Interface). MAPI can be thought of as Microsoft's system-level service in advanced Windows releases (analogous to the Windows printer services).

The full MAPI API has yet to be released, but a subset called Simple MAPI is available that interfaces with Microsoft Mail systems. On non-Windows platforms, applications will use the less robust CMC (Common Mail Client), an X.400 API committee standard interface, until MAPI is ported to those platforms by third parties.

In terms of enterprise-oriented features, EMS will be a substantial product. EMS can monitor attached WAN links and can retry links or take alternate routes when a link fails. When parallel links exist, EMS can balance message traffic loads across them. Inside EMS are queues that store messages until they are forwarded. Priorities can be assigned to important messages so they will be forwarded before low-priority messages. EMS also is modular to the point that the message store, the MTA, and the directory services can all be run on different machines or the same machine.

Developers can write applications that access EMS services with Microsoft Visual Basic, C++ and similar tools. EMS message stores can even be accessed with the industry-standard ODBC SQL interface. The popularity of Windows virtually guarantees that EMS/MAPI will be an major standard.

Serving cc:Mail and Notes

The Lotus Communication Server (LCS) is an active store-and-forward messaging engine that is being positioned as the next generation message server for cc:Mail and Lotus Notes systems. Due for release early next year, LCS will be available for DOS, OS/2, NetWare, Windows NT, and Unix.

The preferred application interface to LCS is VIM (Vendor- Independent Messag-

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Universal Unix Utilities

For years, all versions of Unix have shipped off the shelf with a handful of utilities that track system performance. With cryptic names like sar (system activity reporter), ps (process status), acctcom (process accounting), iostat (input/output statistics), and vmstat (virtual memory statistics), these utilities keep tabs on the speed and frequency of Unix processes, CPU and memory activity, and other key system parameters.

But as the move to client/server computing continues to grow, most of these time-worn utilities are starting to show both their age and their limitations. The sar program, for instance, doesn't gather exactly the same information from HP/UX as from SunOS or AIX. Further, each utility differs in the format in which performance information is presented to users. And because most Unix utilities are as old as Unix itself, they fall short of delivering the kind of performance information needed by managers. A utility might, for example, furnish a snapshot of system activity without offering a way to track multiple snapshots over time. And most Unix utilities don't measure round-trip response times from server to client.

For several years now, a group called the Performance Management Working Group (PMWG) has attempted to address these issues with a Universal Measurement Architecture (UMA) intended to improve the quality and consistency of performance data gathered across all versions of Unix. Membership in PMWG includes nearly all the vendors seeking a piece of the performance management market, including Computer Associates, Compuware's Ecosystems Group, Hewlett-Packard, IBM and Legent.

Originally part of the now-defunct Unix International consortium, PMWG has found a new home with the Computer Measurement Group, a society for data processing professionals. Another friend of PMWG is the X/Open Company Ltd, a non-profit corporation seeking to define vendor-independent operating systems for distributed networks. X/Open's Systems Management Working Group has agreed to approve the efforts of the PMWG when the specs are completed, which members say could take place late this year. PMWG members say no effort has been undertaken to make UMA part of any other standardisation effort.

When finished, the UMA will include specifications for what performance information should be available on each Unix operating system and how that information should be presented to users in a structure called a data pool. Participants say the data pool will operate with short-term data buffers as well as more sophisticated repositories. UMA also will specify APIs for taking data out of the pool and using it in management applications.

Members of the PMWG say the UMA will first be implemented to monitor performance of Unix operating system kernels only. Once this happens, the PMWG may extend the UMA to manage Unix applications, such as transaction monitors and database management systems, and user applications as well. Some sources would like to see UMA incorporate a consistent method of tracing applications and transactions through a network. A kind of time-stamping could be used, for example, to gauge how quickly a request from a particular client resulted in delivery of data to a remote site. Today, tools from Legent and others can monitor this type of activity for particular Unix servers and clients, but the ability to trace multiple round-trip response times across platforms is still missing. Anyone interested in obtaining information on UMA can do so by calling +1-708-655-1812.

Mary Jander

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A Commonsense Plan for Client/Server Migration

Makers of client/server development tools are taking the superstore approach to selling their wares. For every product type — new fourth-generation languages, front-end graphical user interfaces, relational databases, and the like — prospective users face an overwhelming array of choices for remodelling mainframe-dominated networks to fit the client/server mould.

But given the sheer number of tools now on the market, network managers need a methodology that maps development solutions to specific business problems. One such blueprint now available to network planners describes four approaches — or models — for implementing distributed computing. These four models can serve as a guide to help organisations move from mainframe-oriented systems to the more modular and flexible forms of client/server computing. These same distributed computing models also can act as reference points to bring different kinds of development tools into perspective.

In essence, the four models represent different stages in the evolution to a full-function client/server network. The first client/server model, called front-ending, covers the delivery of mainframe-based information to PC clients via terminal emulation. Front-ending development tools offer organisations a quick way to integrate PC clients and mainframe hosts without incurring the long delays usually associated with host-based application development and maintenance.

Data staging, the second step in the client/server development process, involves the extraction of data from host systems for placement on network servers that essentially act as intermediaries for PC clients. Once data has been 'staged' in a decision-support format, it can be accessed by analysts and managers who need to identify and react to business trends and changes. Under this model, client transactions are read only; staged (or 'warehoused') data is updated only from the mainframe side, at regularly scheduled intervals.

The third model, known as the resource-centric approach, sets the stage for the transition to a full-function client/server network. Application logic is moved to client workstations, enabling users to manipulate data stored in departmental relational databases. Resource-centric tools enable users to access data in the formats they need, without learning database query languages like SQL.

The fourth and final model — and one that is only now beginning to emerge — involves the distribution of application logic between networked clients and servers. Interprocess communication takes place through remote procedure calls (RPCs), conversations, or messaging application program interfaces (APIs). It is the distributed logic model that holds the promise of replacing terminal-based transaction networks with a distributed computing approach that combines decision support and transaction processing in a flexible application environment.

A real-world example serves to illustrate how each of the four models can be deployed in the migration to distributed client/server networks. In the scenario, an insurance company is merging two divisions: its property/casualty insurance operations and its life insurance operations. One major function earmarked for streamlining is customer service. Prior to the reorganisation, each operating division had its own customer-service department; the new plan calls for a single department to handle customer calls for both divisions.

As sound as this reorganisation may appear in theory, it poses an immediate problem for the insurer's IS department: up to now, each division has had its own mainframe-based network for policy administration. The immediate job at hand is to consolidate those two separate legacy systems so that customer-service representatives can handle all inquiries, regardless of whether the customer has a life insurance policy or a casualty/property policy.

Along with such system consolidations, the business re-engineering plan also calls for information to be made more widely available across departmental boundaries to help planners and analysts gain a greater understanding of trends and changes. That means giving sales and marketing executives a way to access customer data without requiring them to become experts in the use of databases. The ultimate, long-term goal is to provide a network environment that gives end-users the flexibility to tailor applications to meet their specific needs.

- **Phase 1: Front Ending**

The first issue to address in this reorganisation plan is to merge the customer-service operations as quickly and painlessly as possible. Network designers need to replace the terminal-to-host setup in each division with an integrated client that can handle queries from each mainframe (see Figure 1).

Front-ending offers a relatively simple way to integrate terminal transactions onto a single PC workstation. Developers can use front-ending tools to merge 3270-type dumb-terminal screens with graphical interfaces on PCs.

Such tools rely on mainframe screen coordinates to map portions of those screens to their desktop development environments. Examples of front-ending tools include Flashpoint from Knowledgeware and and IBM's IMS for Windows.

In the insurance company scenario, developers would integrate screens from the two mainframe systems so that customer-service representatives can input a customer's identification number and retrieve data from both systems to be displayed in a single view on the PC display. This concurrent, integrated access is accomplished without disruption to the host systems, which from their perspective are being accessed by dumb terminals.

Front-ending development tools also enable developers to add desktop-based logic that can extend the functionality of host-based applications. For instance, most tools accommodate front-ending via the High-Level Language Application Program Interface (HLLAPI) for connectivity to mainframe screens. Flashpoint has a 'bleed-through' feature; when a Flashpoint application encounters an unanticipated legacy screen, it can continue to run by dropping out of Flashpoint and continuing with just the mainframe screen session. IMS for Windows works with other front-ending applications. For instance, a screen-conditioning utility creates a unique identifier for each mainframe screen, to enable desktop front-ending applications to accommodate screens that are out of sequence.

The front-ending model is a transitional one — it is a logical first step in moving from centralised host-based systems to distributed models. Front-ending makes the most sense when implementing a more distributed model is impractical because of time of cost considerations, when productivity gains or increased functionality can be derived from simplifying access to host applications, and when a need exists to combine pieces of different legacy screens inside one workstation display.

- **Phase 2: Data Staging**

Eventually, however, companies moving to distributed applications will need more than the stopgap measures that front-ending tools provide. Going back to the insurance company scenario, customer service reps aren't the only users who need access to integrated data. Planners and analysts in departments like sales and marketing also need to be able to tap into customer databases. For network planners, that means consolidating customer data from the two legacy systems into a single database that can accommodate decision-support applications. This model, called data staging, is the second step on the road to a more flexible and responsive computing environment (see Figure 2).

Data staging entails making data more accessible to end-users in terms of location

Figure 1: Out with the Old

A relatively simple first step in migrating from mainframe-based to client/server computing is to replace dedicated terminals with PCs that can communicate with multiple hosts. In the insurance company scenario, front-ending tools enable developers to map host screens from the separate property/casualty and life systems to a customer service PC display.

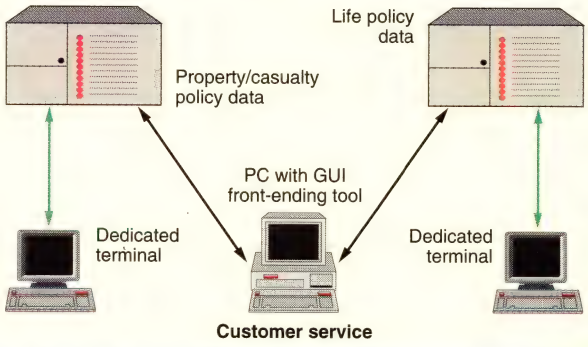
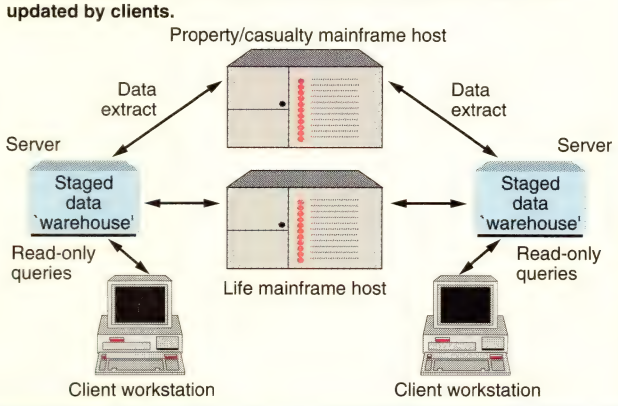


Figure 2: Setting the Stage for Client/Server

Under the data-staging model, mainframe-stored databases are replicated on departmental servers, which act as information `warehouses' for local clients. Data staging is intended to provide quicker access to corporate data; server-stored data cannot be updated by clients.



(on a local, high-performance server), content (calculated fields may be needed), and format (denormalised transaction data). In essence, corporate data is stored in distributed 'warehouses' that can be accessed by different users.

Like front-ending, data staging minimises short-term disruptions to the overall operating of the business. Not only is accessing data on host systems a difficult and cumbersome process, but also a high volume of requests from different user departments would put an enormous strain on those host systems. Furthermore, allowing direct access to host data poses an unacceptable risk that host-stored data would be corrupted.

With data staging, information stored at the hosts is copied into server-based warehouses for end-user access, ensuring the integrity of central transaction data. Departmental users then are able to pull down data from distributed warehouses for manipulation in local applications. The catch is that they must learn to use a database query language, such as SQL.

Tools that enable the development of data-staging designs include database engines that store and deliver data in a format suitable for decision support, job-control languages that automate data extracts from transaction systems without disruption, and products that transform transaction data into decision-support information. Data-staging tools now on the market include Prism Warehouse Manager from Prism Solutions.

The key benefit of data staging is that it enables decision makers to access corporate data. The primary drawback is that most available technologies are limited to read-only access; end-users can manipulate data locally, but they cannot make changes to stored data. While this protects the integrity of central data, it also puts definite limits on client/server interactions. Another drawback is that the time between extracts (or updates) determines the freshness of the data; if data warehouses are updated only once a day, end-users could well be working with outdated information on a regular basis. Finally, most data-staging solutions available today are expensive to implement, both in terms of software licensing and implementation and expertise.

- **Phase 3: Resource-Centric**

Like the front-ending tools for customer service, data staging offers organisations an interim solution for accommodating decision-support applications. That means planners and analysts can perform ad-hoc queries and generate reports based on data stored in the data warehouse — provided they know how to deal with SQL or some other database query language.

Rather than attempt the impossible — which is to make every business analyst a database expert — builders of distributed networks need to provide end-users with a way to get at warehoused data in a clean and simple way. That's where resource-centric desktop tools come in.

Resource-centric tools include products like SQL Windows from Gupta, Visualage from IBM, and Objectview from Knowledgeware. They allow developers to build intuitive interfaces that give users easy access to decision-support data, enabling them to perform analyses on their desktop machines.

In the insurance company scenario, the key benefit of the resource-centric model is that it lets planners and analysts access casualty/property and life customer data without requiring that they learn SQL, relational database theory, or non-intuitive data layouts (see Figure 3 on page 78).

Resource-centric tools extend the data-staging model further by enabling light transactions through support for SQL statements like UPDATE. All resource-centric products have communications facilities for reaching databases, providing the ability to address resource requests to the appropriate server and returning the results back to the client. Most of the resource-centric tools on the market today are heavily focused on providing graphical intuitive access to SQL relational database servers.

There's a downside to providing these transaction facilities, however: users could overwhelm network connections with database requests. Client-side GUI tools generate dynamic SQL statements that may not be optimised to minimise processing time. This opens the possibility of too many clients making too many unpredictable and burdensome requests on centralised resources. Further, many of the resource-centric tools offer limited or no support for transaction concepts, such as commit, rollback, and recover. Vendors of the most popular tools are now working on building up their products to handle enterprise tasks, but developers should still tread cautiously when considering them for important transactional applications.

- **Phase 4: Distributed Logic**

As developers in the insurance company implement the front-ending, data-staging, and resource-centric models, it becomes increasingly clear that the business re-engineering driving them to adopt these different models is not a one-time event; rather, it is an ongoing process involving large-scale, rapid change. This constant

A Commonsense Plan for Client/Server Migration (Cont.)

Figure 3: The Resource-Centric Model

Resource-centric development tools mask the intricacies of database languages like SQL to give non-expert end users an easier way to extract and manipulate data stored on servers acting as staged data warehouses for staged data, as well as perform light transactions on departmental relational databases.

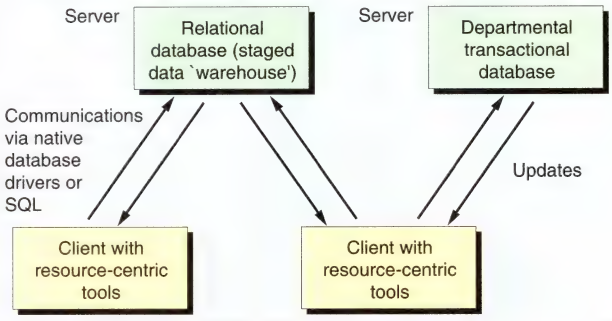
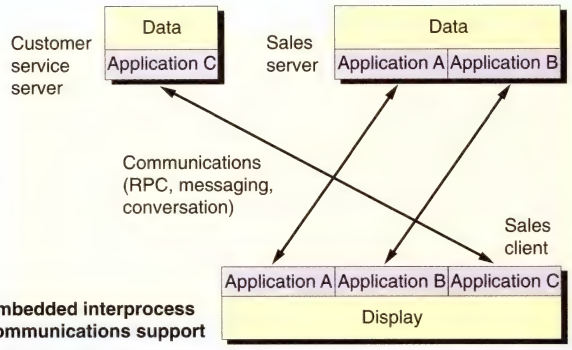


Figure 4: The Client/Server Payoff

The distributed-logic model for client/server networking calls for the partitioning of application code between networked clients and servers to provide a more flexible computing environment.



change puts additional strain on host-based systems, which means the development backlog for system modification continues to grow.

What the insurance company really needs is a strategy for moving away from the inflexible, monolithic host-based applications to a more modular and more flexible client/server solution. The distributed-logic model offers just such a migration path.

Those that embark on the distributed-logic path must understand one important proviso: distributed logic will work only if an organisation is willing to make a serious commitment in terms of time and resources to implement a cross-platform, client/server network. Any hit-or-miss implementations invite the kind of networking anarchy that has left many downsized operations woefully fragmented.

The insurance company's net planners need to develop a modular computing environment that will be sufficiently flexible to support business change. This new computing environment must span all operating divisions, including back-office operations like accounting.

Under the distributed-logic model, portions of an application reside on networked computers. As an application executes, it typically does so on more than one platform, with communication services ensuring the synchronisation of the distributed processes that are invoked (see Figure 4). This approach provides tremendous flexibility because it enables individual users to tailor portions of applications to fit their own needs while ensuring some measure of control and uniformity on the server side. For instance, putting often-used business logic on servers — such as code that handles electronic funds transfers — enables developers to change procedures without having to alter code on every connected client.

For the insurance company, the ideal is to implement a hybrid approach in which controlled central development is combined with local, customised computing. In this approach, IS would work on building core application services or components and on implementing an integrated data management system. In this context, a good distributed-logic tool will scale down as well as up, enabling departmental developers to build custom applications that use the core client/server components.

It's possible to develop distributed-logic applications by using a resource-centric tool in conjunction with a database that supports stored procedures, or by creating custom objects with C++ code. However, this is a limited, low-level approach to implementing distributed logic; designing and managing large-scale applications with any degree of efficiency will require more powerful development tools. Development is easier with the new client/server tools that are emerging.

Examples of this new class of distributed-logic tools include Dynasty Development Environment from Dynasty Technologies and IEF for Client/Server from Texas Instruments.

These tools not only allow for the partitioning of application logic between clients and servers but also generate code for both client workstations and server platforms from application design specifications. Development also can be simplified by embedding communication processes to allows for seamless access and management from within the corporate development environment.

Dynasty uses a knowledge-engine approach to generate C code from design specifications. Once it is generated, the C code can be compiled to run on one or more target platforms. Dynasty is using technology from Netwise for its communications middleware. IEF for Client/Server also is based on a design-to-generation approach.

Lessons Learned

The insurance company scenario serves as a real-world example of how basic changes in business strategies can require major changes in networking environments. The four models for distributed processing serve as the starting point for selecting the appropriate development tools for each phase of the migration to flexible, client/server computing.

Of course, there are many more development tools for each of these models than the ones mentioned above.

Further, the business and network issues that face any given organisation are likely to be different from the ones addressed in the scenario used here. But the important point is that reference models help developers focus on the best ways to support business objectives and to assess the technologies available for implementing a given reference model.

Many organisations are now finding that breaking client/server strategies into a series of reference models helps crystalise the decision-making process, ultimately creating a framework for hashing out problems and solutions related to distributed computing.

The reference models and the available tools are merely means to an end. The primary objective remains to accommodate business change more effectively.

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ing), a public-domain API developed by Lotus and other vendors. VIM is not tied to any particular operating system.

Until LCS comes along, VIM is being used as an application interface to the extensive installed base of cc:Mail and Lotus Notes. VIM is being fully integrated into the Lotus product line, giving developers access to cc:Mail directories, distribution lists, and Notes applications. Applications that already have been developed with VIM include mail-enabled document management, medical office management and billing, hotel sales automation, and freight tracking programs. As with Microsoft's MAPI, VIM is primarily a desktop API. Lotus also supports MAPI, CMC, and MHS interfaces to its store-and-forward messaging backbone.

Also Available in Red

While EMS and LCS have yet to see the light of day, Novell's MHS has been around for years; more than 1000 registered corporate and independent software developers have written MHS applications to date. Novell's latest version of its store-and-forward messaging service is NetWare Global MHS, a server-resident application that runs as active Netware Loadable Modules.

Access to MHS is handled very differently compared with both MAPI and VIM. MHS has no programmatic interface, *per se*. Instead, message files are sent by appending an ASCII header that contains addressing and delivery instructions. The ASCII address file and attachments in binary or any file format are saved to a directory that's regularly polled by the MHS server. No procedure calls or library functions are involved in this process. Although it sounds crude, this approach is very similar to the way mail messages are addressed in SMTP — the Internet messaging workhorse.

MHS servers have advanced features like automatic least-cost route calculation and directory synchronisation services that update MHS directories throughout the enterprise whenever changes are made. With the next release of NetWare MHS directory services will be integrated with native NetWare server directories.

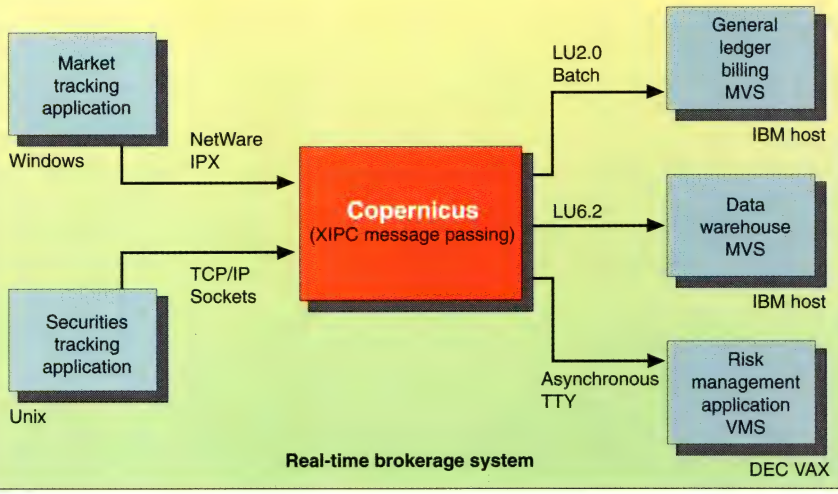
To create a degree of programmatic interface to MHS, third parties have created Windows Dynamic Link Library (DLL) calls that automatically address messages with the MHS format, using a Windows address table lookup menu. Novell itself has recently released a new set of Windows DLL libraries that give VIM, Simple MAPI, and CMC applications access to MHS services. With these libraries, off-the-shelf or custom applications written to VIM, MAPI, or CMC will run on NetWare MHS clients without modification.

For document management applications, NetWare MHS supports an embedded document translation service that automatically translates between word processing formats. For remote users, Novell provides a Remote MHS product that makes MHS, VIM, Simple MAPI, and CMC interfaces available to remote Windows applications.

As with synchronous client/server and messaging-passing products, the enterprise capabilities of store-and-forward messaging backbones should be viewed with some scepticism. Despite their promise, store-and-forward products don't yet have the heterogeneous support necessary for full-blown delivery of documents, images, and forms across an enterprise network. Seamless directory synchronisation between dissimilar store-and-forward systems is still to come, as is full X.500 compliance. And store-and-forward messaging backbones will not be suitable for transactional applications unless store-and-forward services are integrated into transaction journalling systems).

Figure 3: Centre of the Universe

Copernicus, a real time data translator, represents an emerging class of products that facilitate interprogram communications by translating between different data types and structures to link a full complement of computing platforms, as in this brokerage network.



Forging Ahead

Clearly, the enterprise-integration movement is in the early stages of development. Eventually, enterprise architectures most likely will include elements of all three interprogram communications models (see Figure 2 on page 68). In these networks, synchronous RPC and SQL will be used as local, interactive communications modes between tightly coupled systems. Messaging APIs will be deployed where flexible coupling is needed, particularly over WAN links. And store-and-forward backbones will link loosely coupled applications on internal and external systems. This type of architecture will be more feasible when all three communications models are available.

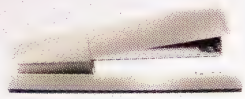
Also emerging though, is a new class of products that can help developers move information between dissimilar systems.

One example of this type of product is Copernicus, a real-time data translator from New York-based New Paradigm Software. Copernicus helps make up for the weakness in many interprogram development products that don't translate between different data types and data structures on different machines. Copernicus captures messages from legacy and client/server systems, using a multiprotocol interface that handles TCP/IP, X.25, LU6.2, and other major protocols (see Figure 3). Captured messages are parsed by a comprehensive set of rules that are managed by a high-performance relational database management system. During the translation, each field in the message is analysed and transformed into a format appropriate for the target system.

Copernicus can rapidly translate between different machine types, floating-point formats, character types (such ASCII and EBCDIC), monetary forms, record layouts, data structures, and so on. Once a message is translated, it is forwarded to the target system via the appropriate protocol. Copernicus can replicate the data it transforms and send copies through the enterprise to various applications and data stores.

Without a product like Copernicus, enterprises must connect dissimilar applications by building a custom gateway that soon becomes another hard-to-maintain bottleneck between applications. Copernicus is intended to provide automated inter-application messaging services with a minimum of programming overhead and maintenance effort. In short, it's like having a highly proficient, multi-disciplined developer in a box.

Steven King is a Contributing Editor of Data Communications magazine. He is based in Framingham, Massachusetts.



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Keeping in Touch With PCS

Personal Communications Services, the latest wave of the communications revolution, is about to break around the world. Stewart Fist explores the concepts and the technology.

The dreams of PCS (Personal Communications Services) proponents include the idea that anyone, anywhere, can be located and contacted by phone — the concept incorporates the so-called Future Public Land Mobile Telecommunications System (FPLMTS), Universal Personal Telephony (UPT), Advanced Intelligent Networks (AINs) and the use of pocket-portable (wireless PABX/LAN and Telepoint) and cellular phones. So PCS is more than just 'cut-down cellular.'

Some have defined PCS as the ability to 'call or be called anywhere, at any time, with any combination of voice, data, image and video services' — which is pretty close to the definition of the term 'future communications systems.' A recent study prepared for the New Zealand Ministry of Commerce on the introduction of DECT (Digital European Cordless Telephone) technology, wafts even more lyrically, aligning PCS closely with the ITU's FPLMTS. It believes the initial PCS services will focus on:

- Satellites for very wide area coverage requirements;
- Cellular and micro-cellular systems using GSM and digital AMPS networks for wide area and high mobility requirements; and
- Micro-cellular and pico-cellular systems using cordless telephony for home and office applications.

But most of us don't use the term in this all-encompassing way — we would use it only for the third category here.

However, many certainly believe that wireless 'last 100 metres' systems will probably become the dominant form of telephony in the next century — and this then allows numbers to be attached to people, rather than to the end of wires. In some cases this belief extends to wireless as a substitute for twisted-pair in the local loop, and right now a number of technologies cross the boundaries between PCN/PCS and Wireless Local Loop (WLL) — namely CT-2 and DCS-1800. Extended TDMA from Hughes (E-TDMA) is another attempt to produce an all-purpose radio technology, but it also seems more suited for WLL applications.

Many see the current PCS emphasis on the air-interface as only temporary; in the long-run PCS will become more concerned with integrating the network facilities which are needed to locate users, and with sophisticated methods of automatic billing and identification on a global scale.

But before this is possible, the intelligence must be distributed across the public network and designed to cater for all of these services. In the ideal world, special mobile-cellular switches and location registers will no longer be necessary, since the general public network will hold all this information. No matter where you enter the network, the local exchange should have access to visitor and home-location registers — probably using global X.500 type directory services which can be updated automatically as your cellular phone moves around, and which can also be deliberately modified by the user.

There's some confusion about the PCS-PCN (Personal Communications Network) difference, but in practice the two terms are

PCS and Spectrum Efficiency

Spectrum efficiency in cellular and PCS systems are always quoted in comparison with AMPS (the Advanced Mobile Phone System) or in terms of useable channels per megaHertz:

- GSM uses two 200kH-wide carriers (go and return) in its basic frequency allocation, and it jams 8 users into each carrier using time-division. In my calculations this means that 20 users each share 1MHz of bandwidth.
- DECT has 12 users sharing 1MHz of carrier bandwidth, but they only make 10 carriers available in 20MHz of spectrum, so this represents 6 users per 1MHz — all other factors being equal.
- Analogue AMPS is nearly as good as GSM, even though it requires a pair of 30kHz wide channels/carriers. It has a megaHertz capacity of 16.7 users.
- CT-2 is a TDD system which requires a single 100kHz carrier for each call, so it would have 10 users/MHz.
- CDMA systems are non-blocking, and have no set bandwidth allocated to each user (additional users just degrade the voice quality), so they are in the 45 user-per-MHz range at their upper limit, but probably at about half that capacity for best quality. They seem to be in the order of 20-25 users per MHz.

Of these, DECT is the lowest of the lot by quite a long way, but note that these figures are only for spectrum-efficiency, and can't be directly translated to 'system capacity' figures — except in isolated cells. They represent the theoretical capacity provided by a single transmitter — and so would only be translatable to total capacity in Telepoint systems or in an office where there was no cell-coverage overlap.

As soon as you introduce nearby cells, then cell-reuse ratios come into consideration in all TDMA and FDMA systems. AMPS has a N=7 reuse factor, while most TDMA systems are N=7 or N=9 — and this is where theoretical capacity gains are dissipated. CDMA gains its enormous advantage here because it is able to use the whole bandwidth in every cell, and in every cell-sector (the angular subdivision of a cell area through directional antenna).

Stewart Fist

interchangeable — although many pedants would deny the obvious. In the United Kingdom, the term 'PCN' was applied specifically to DCS-1800 as a local-loop and Telepoint technology, while the Europeans and Americans often tend to use it to mean the networking side of PCS. But none of them are consistent.

The US Federal Communications Commission (FCC) recently defined a 'PCN terminal' as an inexpensive pocket-sized terminal by which 'it may soon be possible to reach individuals at anytime in any place using a single telephone number,' which is the UPT idea under a different acronym.

With UPT different phone numbers will be attached to:

- The person him/herself — irrespective of the type of terminal used or the temporary location;
- The person's job status; and
- To other positions they hold (such as being secretary of a club, etc.).

These last two would be transferable to the next 'office' holder. For UPT to work with both wired and wireless phones, and with a range of radio links ranging from home-cordless to satellite-cellular, however, we need the personal identification to not be in the handset but in a smartcard inserted into the handset — like the famous SIM (Subscriber Identification Module, which unfortunately is GSM-specific). You would use this smartcard internationally in hotel-room wired phones, through street-phones, and in aircraft. So maybe, in the ultimate extension of the term, your 'PCS' is just a smartcard, and the rest is flexible and almost incidental.

However, we also need to pay attention to the air-interface. If everyone is to be able to use a pocket-size phone at home via a home base station, take it with them to work in the morning and use it in a car or train while commuting, then also use it at work through wireless links to the company PABX — and have multiple numbers attached to that phone — then we need high-capacity radio phone systems, thousands of base stations, highly intelligent networks — and probably a lot of money. There's plenty of spectrum available, but it will need a bit of shuffling to get the spectrum-hogs off the airwaves.

But really, this is all blue-skies futuristic stuff. At the present time, the discussion about PCS is about mass-produced pocket-phones which are cheaper to use than cellular. There's also a tie-in with bandwidths in the 1.5 to 2.0GHz range, because this offers the right trade-off between coverage area, capacity, and vacant spectrum.

So this is practical PCS in the 1994-95 timeframe:

- In Asia and many undeveloped countries, and in Australia and the United Kingdom with new alternative/competitive carriers, the PCS concept is strongly related to wireless in the local loop, and so-called 'cut-down cellular' systems for pedestrians;
- In the view of AT&T, Apple, Motorola, IBM, HP and a few other computer-communications companies, the PCS concept will also extend past phones to PDAs (Personal Digital Assistants) palmtop, notebook and pen-based computers with built-in radio links and short-messaging capabilities;
- For Time-Warner, TCI and a large number of US and UK cable companies, the PCS idea is more related to pedestrian-cellular systems connected to local exchanges over their coaxial cable;
- In Britain it will mean the two DCS-1800 networks being promoted more as vehicular cellular networks; and
- To the FCC, it means UPT/pocket-phone services utilising the spectrum about to be auctioned around 1.9GHz.

Which brings us to two other terms which are creeping into the PCS debate also — especially in the American FCC:

- High-tier PCS, which is applied to the 'cellular-like' DCS-1800 and DCS-1900 (the United States version) systems which usually have air-interfaces defined along with complex network services; and
- Low-tier PCS, which is more in the nature of the Telepoint pocket-phone. CT-2 was a good example; it was predominantly a radio-access technology, which didn't depend on a complex public network.

There are now demonstrable commercial successes in both High-tier and Low-tier PCS. The two DCS-1800 services in Britain are being sold as cheap cellular systems, and the take-up rate has been high, while in Hong Kong and Singapore, low-tier CT-2 has certainly more than proved itself in the marketplace.

The US carriers seem to be looking primarily at this low-tier end; their statistics show that 30% of American homes have a cordless telephone, and 10 million people use a pager, so they see PCS as a natural extension of these services with a bit of value-added.

However, a major marketing study conducted in the US last year by Alexander Resources (AR) found that promoting PCN/PCS on the basis of its low-tier 'away-from-home-phone' feature received very little support from potential customers at the cost envisaged ($40 per month). A figure more like $7 per month was thought to be more reasonable!

Of course, if they gave them away free and offered free local calls all day, it would be more reasonable still! In the final analysis, success is measured by the profits earned by the company, not by the number of people who sign on to a service.

The AR survey also found that potential PCS customers wanted to retain their wireline connection — PCS was seen as an 'extra,' not a replacement — and they

Comparing PCS Technologies

	CT-2 PLUS	DCS-1800	DECT	JCT/PHP	CDMA-1900	B-CDMA
Frequency Range (MHz)	864-868 944-948 (952)	1710-1785 1805-1880	1880-1900 (+20 in reserve)	1895-1918	1850-1970	1850-1970 also 1500
Access Method	FDMA/TDD	TDMA/FDD	TDMA/TDD	TDMA/TDD	CDMA/DS	CDMA/DS
Modulation	Two level GFSK	GMSK	GMSK	pi/4DQPSK DQPSK	QPSK/DQPSK	QPSK
Speech Coding	32Kbps ADPCM	13Kbps RPE-LTP	32Kbps ADPCM	32Kbps ADPCM	8.5Kbps Q-CELP	32Kbps ADPCM
Carrier Separation	100kHz	200kHz	1.728MHz (2MHz)	300kHz	1.25MHz	8MHz
Number of Carriers	40	374	10	40	Not Available	Not Available
Time Slots and Channels	2 (TDD) 1 Channel	8 8 Channels	24 (TDD) 12 Channels	8 (TDD) 4 Channels	Not Applicable	Not Applicable
Channels per MHz	10	20	6	13	20-25	20-25

TDD = Time Division Duplex FDMA = Frequency Division Multiple Access TDMA = Time Division Multiple Access CDMA = Code Division Multiple Access
GMSK = Gaussian Minimum Shift Keying ADPCM = Adaptive Differential Pulse Code Modulation QPSK = Quadrature Phase Shift Keying

placed a much higher value on emergency/safety considerations than on mobility.

The only country with any long-term experience of low-tier PCS (CT-2) is Great Britain — and the experience was, quite frankly, disastrous. But there were reasons that are well worth re-examining.

The UK CT-2 Fiasco

The United Kingdom's CT-2 'Telepoint' system flourished briefly in the mid-1980s as the world's first digital mobile telephone. Ferranti designed CT-2 and licensed it to Shaye and a couple of other manufacturers. Northern Telecom is now the main proponent.

As it was implemented in London originally, CT-2 used the standard POTS telephone network, and simply added wireless links for the last 100 metres. The base stations were self-contained PC-based boxes screwed up on second-story walls or street-posts, and each base could provide a few channels (usually six) in the immediate vicinity. There was no cell overlap and you could only dial-out — so there was no need for intelligent switches, or location registers, etc.

The only network consideration was to authorise the handset, and to maintain billing records. Each night, the central office would poll the base station, down-load billing information, and updating authentication tables. During the day the base would make decisions about access itself.

The handset design parameters included top-quality voice, based on 32Kbps ADPCM voice coders, and the phones were small, and portable — and affordable. CT-2 seemingly had everything going for it — if what you wanted was a portable telephone-box! But CT-2 nevertheless died a horrible death in the United Kingdom, crushed by the bureaucrats who:

- Prohibited two-way calling so that CT-2 could not compete with analogue cellular phones. In the street, you had the ability to place a call but not to receive one, because the network was devoid of location registers;
- Licensed (in the interests of 'competition') four CT-2 companies in London, all using incompatible equipment. So they sub-divided an incipient and unknown market; made inter-company roaming impossible; forced the companies into quadrupling infrastructure facilities — and successfully destroyed any chance that anyone could make profits; and
- Refused to intervene in a marketing war between air-time resellers of analogue TACS. High-tier mobile phones were being given away for next to nothing, while CT-2 dealers (who had no way to resell air-time) were flogging pocket phones (known by then as 'brain-dead cellular') for $250.

So CT-2 died in London, but the memory lingers on. Anyway, CT-2 initiated the PCS era — if that's the era we are now entering. It began in chaos and ended with a whimper; yet the technology on which it was based was exceptionally good once it got its Common Air Interface (CAI) and network intelligence to a point where it could support two-way calling. In fact, the later derivative called 'CT-2 Plus, Class II' is still quite probably the best low-tier PCS technology available for Australian conditions.

CT-2 is not a 'failed' technology; it is booming in many parts of Asia, and it has now established a significant presence in France and Canada. Telecom Australia's trials of its Talkabout CT-2 product in Brisbane and the Gold Coast have also been reasonably successful, with good reports coming from the users. At the time of writing, the most recent word was that a Sydney service will begin this month.

There are a couple of flavours of CT-2. In the UK they eventually got together (too late) behind the CAI standard which allowed cross-vendor interworking. Later handsets also had built-in paging receivers (essential to receive notification of incoming calls in a one-way system).

Further design variations have added two levels of location notification. Carriers can now implement a system which either registers your handset with a local base station when you press a button (useful if you were eating in a restaurant for a reasonable period of time), or they can provide a more 'cellular-like' network which involves automatic registration.

CT-2 Plus, Class II is the automatic-registration system, and the older one-way version now seems destined only for Asian local-loop applications where location is fixed. Australia has been trialling the press-button registration system in Brisbane, but I assume that Telecom intends moving up to full Class II, if and when it expands the service.

The 32-bit ADPCM used in CT-2 is the same voice-compression technique widely used in ISDN networks. You can't really pick when CT-2 is being used at the other end of a phone link; and no current cellular phone standard comes even close. And since these phones only reach out a few hundred metres to a base station, they also tend to be reasonably static-free.

Modemised data and fax can be transmitted over CT-2 into wireline networks at

close to normal rates without worrying about the vocoder distortion which creates the mobile-data problems over digital cellular. In France, Apple makes and sells a highly successful PCMCIA radio modem card for CT-2 networks called the Apple PowerBop for their PowerBook portables. The PowerBop handles fax and data over the French BiBop CT-2 Plus service.

The Canadians seem to be continuing to work on the extended CT-2 Plus technology with the aim of migrating it into the 1.9GHz spectrum band. With CT-2 Plus they've reserved a special channel for signalling and control and they aim to use this for a D-Channel ISDN interface — thus challenging DECT directly as an extension to the ISDN network.

DECT: Intrinsic Problems?

Digital European Cordless Telecommunications is a two-way CT-3 derivative which can provide voice and data using TDMA/TDD — it is time division, but with go and return slots in the same frame. Having only one carrier simplifies the R/F stages and reduces size and complexity.

The standards were set by an ETSI committee which finalised the bulk of the recommendations in March 1992. DECT was primarily designed for wireless PABX and wireless LAN connections, but it also has a 'Telepoint' public-switched application in city streets, and it can provide hand-off to slow moving vehicles.

Currently most DECT equipment has proprietary air-interfaces which can only be used within a single-vendor domain. However type-approval and the common-air interface standard called GAP (for Generic Access Profile) have recently been set — but GAP only becomes compulsory in mid-1995. Products are now becoming available with this GAP standard, but there's a lot of so-called DECT equipment around which is non-approved.

DECT was given 20MHz of the radio band between 1.88 and 1.9GHz, subdivided into 10 1MHz carriers; the remainder seems to be vacant as guard-band. Despite talking to a number of leading DECT experts in Australia, it's not been possible to untangle the reasons for this bandwidth wastage. Officially the documentation claims that DECT uses 1.728MHz carrier spacings, however all the general literature talks about 1MHz carriers.

Ten channels of 1.728MHz, with 2.2-MHz on each end as guard band, is perilously close to 20MHz, so I suppose ETSI has learned from its wide-scatter GSM-interference experience.

There are 12 full-duplex channels (24 slots) provided in each base station's 1MHz transceiver bandwidth. So up to 120 simultaneous calls can be supported in a fully-provisioned, single, isolated cell, and 12 callers can use a single base-transceiver.

Inside an office, with correctly configured base station equipment, a wireless PABX system can provide a mix of channels with different bit-rates. They've defined a 4Kbps rate for Telex and low-rate data; a 16Kbps rate for internal-telephones and payphones; the standard 32Kbps audio bearer for normal public telephony and G3 fax; and by consolidating two slots, a 64-Kbps a high-quality trunk link.

Transceivers can use any of the 10 defined frequencies and can aggregate any adjacent time slots. So a user could grab up all 12 slots in a frame, and get access to 384Kbps of bandwidth. Each slot delivers 320 bits of payload and 68 of overhead for signalling and CRC. Frames repeat every hundredth of a second, so DECT will generate a 100Hz interference tone in nearby audio systems, telephones, cassette recorders and hearing aids, just like its big brother GSM. The UK Department of Trade found this back in 1989.

When DECT cells overlap, the frequencies need to be shared-out, as in any FDMA/TDMA cellular system. No one is officially quoting any 'cell reuse factors' yet, but it appears that DECT needs the same N=7 and N=9 bandwidth divisions as GSM. Within an office, however, bandwidth reuse will be highly variable.

Outdoors, DECT handsets will typically have a power output of 250mW and a potential range of 200 metres, so it is expected that they'll eventually be used for public-Telepoint access, but no one is designing networks yet. DECT doesn't cope well with multiple-reflections or the Doppler-effect of fast-moving vehicles, but it does allow pedestrian-speed hand-off provided the cells overlap and the network has sufficient intelligence.

GSM interworking is also built into the DECT handsets, and later it will be possible to use DECT as a short-range satellite service to a GSM or DCS-1800 retransmitter on trains, etc. to provide call-out facilities.

One recent report on DECT from Europe has this to say: 'The handset initiated handover procedures in DECT are also designed to cope with increasing traffic densities, with the result that locations where very dense coverage is required can easily be accommodated by installing more base stations in that area, with no cell planning and little impact on the rest of the infrastructure.' Another report says DECT has the 'capacity to handle a high level of user density — some 50,000 users per square kilometre . . .' Now I must be missing something here, because my calculator tells me that DECT is less spectrally-efficient than GSM — which, in practice, is only between 1.2 and 1.3 times as spectrally-efficient as the old AMPS analogue cellular standard.

DECT is only efficient within an office, in an isolated cell. There's nothing intrinsic in the technology that makes it any more able to 'cope with increasing traffic densities' than the alternatives — except for its low power.

The DECT literature says that cell planning can largely be obviated by self-tuned networks based on Adaptive Channel Allocation (ACA). ACA systems listen for interference, and they use any one of the full range of channels, provided it is relatively noise-free. They hop around choosing the best spectrum available, and share out the interference. In this rather complex way, they are doing what CDMA networks do automatically — spreading the signal over the available spectrum.

Like CT-2, the DECT standard calls for 32Kbps ADPCM voice coders which give good quality, and it adds encryption for security in an office. Obviously the lower-quality 16Kbps voice standard would need 16Kbps ADPCM voice coders at both ends.

At 32Kbps, one would expect the DECT voice codec to be better and faster than GSM's RPE-LPT vocoder, although some reports say that voice-coder delays and hybrids in DECT are introducing two distinct forms of echo — network echo and acoustic/handset echo — and these need special processing treatment.

Currently, the handset manufacturers are using echo suppression by attenuation — remember, this is a ping-pong, half-duplex system. So the handset must remove the attenuation whenever the terminal user stops talking, to allow them to hear the remote party speak.

British DECT expert, David Powell, complains that two people communicating, when both are using DECT terminals, is "an almost unworkable option" and says that DECT's voice-quality represents "a retrograde step," He says: "This method of operation involves both parties exercising a high degree of discipline, because natural speech interruption is impossible, due to the attenuation being in place at the terminal end."

It sounds like a return to the 'Roger, Over and Out' days. However DSPs and digital echo cancellation will certainly solve the network echo problem eventually.

Handset echo is a different matter. There's always mouthpiece to earpiece feedback in any phone, and so rapid switch of echo cancellation produces a 'pumping' effect whenever there's background noise. Powell suggests that new forms of software echo control will need to be devised to "make the echo canceller unit more resistant to divergence."

But if DECT isn't really providing any capacity gain over GSM or DCS-1800 systems, and has voice-quality problems, why bother with the technology at all? Why not just produce a lower-powered DCS-1800 for office use, and gain more directly from the development work on GSM, and from mass production of the existing technol-

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Adrenalin HAY004

ogy? Reducing power surely wouldn't be a problem?

It's possible that this is the reason why the British are pushing DCS-1800 so strongly; one suspects that the European emphasis on DECT has a lot to do with anti-British feelings, possibly compounded by the problems GSM has with data.

DECT was designed from the start for cordless LAN applications. ETSI is still defining data-service profiles to support packet and circuit-switched data, Ethernet LAN, and interworking units for ISDN and GSM services. They say in the promotional material that the system is capable of providing a wireless LAN connection at a peak data-rate of 1.152Mbps, if required, by concatenating all slots within a frame.

The maths here is a little hard to understand; a 12 channel aggregation of 32Kbps each only provides a data-rate of 384Kbps. However the system is supposed to have 50% overheads — so if they sum both go and return channels and add 50%, they do get a figure of 1.152Mbps. But that's both ways, and no one ever quotes data-rates bi-directionally, do they? And doesn't the industry usually quote throughput, rather than raw data-rate?

But, if that isn't enough, in recent times I've also seen a claim that a DECT wireless LAN installation can have a maximum data throughput of 10Mbps! They do this by aggregating all 10 channels — but you'd then need to take over the whole network and build in some complex segmentation/reassembly scheme. Olivetti was working on such a system a few years ago.

But then, why bother using DECT and hogging all that voice bandwidth? Why not use a special high-speed wireless LAN?

In my opinion, DECT has all the tell-tale signs of ETSI over-engineering and of GSM's equipment interference problems. And to a cynical technical journalist, ETSI's tentative back-door release of the technology into the European markets is a pretty reliable indicator that there are intrinsic problems.

DCS-1800: Cut-Down GSM

Digital Communications Specification (or Digital Cellular Standard) in the 1.8GHz band is a form of GSM which is currently in commercial release in the UK, will soon be operational in Thailand, and is also being trialled in Germany and other European countries. In Australia the bands between 1710-1785MHz and 1805-1880MHz have already been reserved for DCS-1800.

This is low-powered GSM modified by an additional 11 'Delta' recommendations. It allows two operators to share a network; relies on high-capacity cells; and is designed for transmission distances of a few kilometres or less. Because of the higher radio frequencies used, roughly 3 to 5 times as many cells are needed to cover an area than would be required for GSM (which itself needs smaller cells than AMPS).

In a recent publication, Ericsson engineers have pointed out one positive aspect to this short-range technology: 'At higher frequencies, the radio signal attenuation is greater, which will reduce the size of the cell's coverage area at a given output power. The 1800MHz operators will then have to build a larger number of cells, which will drive the development of smaller and cheaper base station equipment.'

Well, now we know how to reduce capital costs — just build more, smaller base stations and drive the costs down! Local councils will be pleased.

At these gigaHertz frequencies the handsets are generally smaller than GSM — it's the size of the R/F electronics which set handset limits. The manufacturers claim that DCS handsets will also be cheaper in the long-run due to the mass production potential intrinsic in the very substantial bandwidth (2 x 75MHz) allocated to these services. Since these devices are basically GSM with a different R/F end, I would have thought that the costs of DCS and GSM would remain comparable — but 'price' and 'cost' are quite disconnected concepts these days.

The Mercury DCS-1800 service in the UK (called One-2-One) was launched in London with a 2 x 15MHz spectrum allocation, and a rival Hutchison service called Orange (with the same bandwidth) is now rapidly spreading everywhere. Mercury sold its service to the public as a low-cost radio local loop within the M-25 (peripheral ring-road) area. They won't provide a coverage map, so it is hard to know how far their service now extends.

The One-2-One sales-advantage was free local calls in off-peak times. It proved to be a popular promotional idea; the statistics show that it carries four times the number of calls per capita than Orange or the cellular systems — but three-quarters of these calls are made in free times. The shareholders may not see free calls as a 'success' in the same light as the customers!

Hutchison's Orange is being sold as a cheap form of cellular to people who need full mobility, so it is more in competition to Vodafone's GSM service than it is with Mercury. Orange now claims to cover 50% of the UK's population area, and they publish a map which shows the coverage extending south and east from London and up the spine of the island to major market-areas around Manchester and Liverpool, then on to Glasgow and Edinburgh.

Orange promises to have 70% coverage by end of 1994, and 90% by the end of 1995. They promote four low-usage billing plans, and offer 15 minutes of free time within the standard £15 monthly subscription.

Both of these services offer voice mail, call waiting, call forwarding and itemised billing as a matter of course. It is hard to say which is cheapest; Orange bills on a per-second basis, while One-to-One bills in 30 second increments.

Austel, in its Wireless Personal Communications Services report (released in August last year) says: 'In Austel's view, DCS-1800 would appear to be a logical and necessary extension of GSM. In addition to GSM economies of scale there are inherent economies of scope, in that the supporting infrastructure is identical.' If you can work out where the economies of scale and scope are in adding more carriers to a three-carrier GSM network, please let me know! GSM subscribers already carry a $900 million (total) capital infrastructure load into the future, which will manifest itself when competition from AMPS disappears.

US Energy, Local Apathy

We may well be leaning toward DCS-1800 in Australia but that's about as far as we've gone toward introducing PCS — and there doesn't appear to be any pressure from industry or the public to hurry matters along.

Austel's report declined to make substantial and definitive recommendations and simply summed up the disputes and experience around the world to date. It found its way from the Communications Minister (whoever it was that week) to the bureaucrats 'for further examination of implications for policy,' and to the Spectrum Management Authority's Radio Communications Working Group to examine the spectrum allocation aspects. And that's where it appears to lie at the present moment; the recommendations still haven't come back through the Department.

In fact there doesn't appear to be any sense of urgency in Australia or in New Zealand with both countries either commissioning or digesting reports in a leisurely way. This is in direct contrast with Hong Kong, where a plan to licence six PCS operators has been released and the US, where spectrum allocations and auctions are going on at a furious pace.

In the US, the FCC has allocated a total of 160MHz between 1850 and 2200MHz for PCS services (this is four times the spectrum for cellular). This has been divided into two chunks: 120MHz for licensed PCS services; and 40MHz for unlicensed PCS devices. The licensed allocation is to be channelised into three 30MHz channel blocks and three 10MHz channel blocks. The unlicensed allocation is channelised into two 20MHz blocks; one for devices that will provide voice/isochronous services (1890-1900 and 1920-1930MHz) and the other for data/asynchronous services (1900-1920MHz).

Geographically, the PCS service areas have been defined as 51 Major Trading Areas (MTAs) and 492 Basic Trading Areas (BTAs). Existing cellular licensees are per-

The shape of things to come? A researcher at Bell Northern Research (BNR), the research and development arm of Northern Telecom, prepares to measure the acoustic properties of prototype advanced personal communication devices. These anechoic (sound absorbing) chamber tests will help BNR optimise the form and function of future PCS products.

mitted to participate in PCS, provided these are outside their existing service areas. Local exchange carriers are permitted to apply for PCS licences on the same basis as other applicants, but preference is to be given to small businesses, rural telephone companies, and businesses owned by minorities and women.

The key division is between high-tier cellular based systems — which will use CDMA or possibly DCS-1900 (a slightly modified DCS-1800) and have car-speed hand-off, and low-tier pocket-phones which will almost certainly be CDMA — although there are still a couple of TDMA-derivative contenders.

Until recently, there was no requirement on bidders to even specify the type of technology they wished to use — which created problems for companies worried about adjacent-channel interference, and no one is paying any attention to creating a single air-interface standard, or imposing roaming requirements on the lucky-lottery winners.

The FCC has solved this roaming problem (to its own satisfaction) by licensing 11 channels for nationwide PCS use. One of these has already been assigned to Mtel — a 'pioneer's preference' licence in recognition of some earlier development work. Mtel now has 50 kHz of radio spectrum to build a two-way wireless network to be called the Nationwide Wireless Network (NWN) for laptops, palmtops and PDAs. The network will also utilise pocket-sized two-way pager devices capable of acknowledging message receipt.

This is a 'location independent' system, meaning that messages can be sent and received without knowing the city in which the other party is located. Since the network will consist of more than 3,000 base stations, NWN will blanket-call all metropolitan areas and eliminate the need for users to notify the network with 'roaming' or location instructions. This appears to be an idea which might work with moderate capacity, but I can't see it working with millions of users.

MCI has been very active in PCS; last year it put together a consortium of 150 companies, with the aim of providing a single nationwide coverage. Currently it is conducting a number of trials with different partners across the US, using Qualcomm's 1900 MHz version of the CDMA cellular technology.

The first phase of trials are in Dallas and Washington. In Dallas, MCI is working with TeleCable, one of the 20 largest cable providers in the nation where the coaxial cable is used as the inter-base station link. And in Washington, MCI is working with American Personal Communications — another company with a pioneer preference licence; APC developed the Frequency Agile Sharing Technology system, which allows PCS networks to share spectrum with existing microwave users without interference. Time Warner has also successfully completed PCS trials over its Full Service Network in Orlando, Florida — again, using CDMA.

Judging from the correspondence about PCS trials flowing across the Internet, one would conclude that Qualcomm's CDMA-2000 leads the field but is closely followed by CT-2 Plus, then comes the InterDigital and Omnipoint (both CDMA) technologies, and then a straggle of TDMA technologies. Obviously DCS-1900 trials are happening somewhere, but any information about them is nigh impossible to come by.

To sum up the American position: many experts believe that PCS is likely to stall in the starting gate in the US because the competing business interests aren't going to put aside their differences and agree on a common standard. Many project that this will cause 10 years of confusion — and when customers are confused, they always reject change and refuse to buy.

The situation in arch-rival Japan is also a little unclear but at least things are happening. The Japanese have never had much success in mobile communications, and with the pressure that Motorola is now putting on their industry, it is unlikely that they'll be able to enter this market directly. However their low-cost Asian subsidiaries are looking at Personal Digital Cellular (PDC) and Personal Handy Phone (PHP).

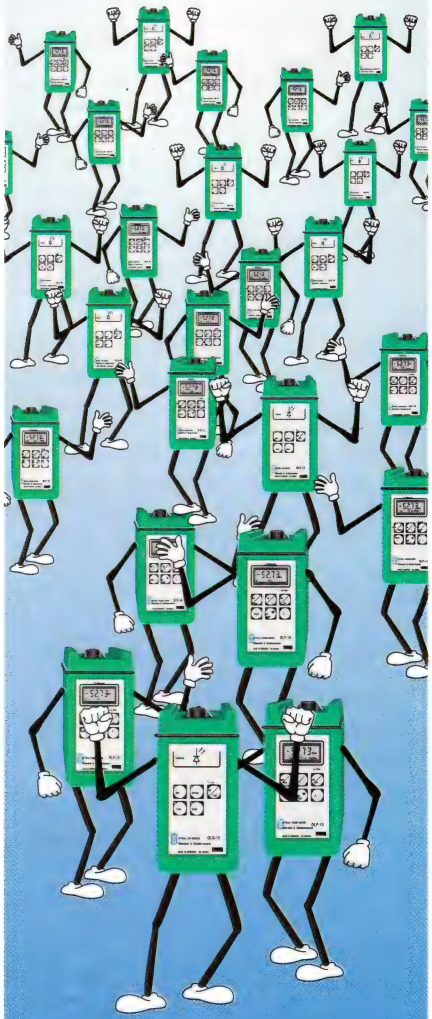
Their version of TDMA cellular (now called PDC, in the 800MHz and 1500MHz bands) has never been accepted outside Japan, and it has hardly been a success there — mainly for cultural reasons.

No subordinate salaryman would think of owning a mobile phone (which is very much a status symbol) unless his immediate boss already owned one: we would call this one-upmanship — but to the Japanese boss it is losing face. And since many Japanese bosses prop up their status by having their phone calls screened by a secretary, a mobile is out of the question. This appears to be the best explanation for the relative failure of cellular systems in Japan — together with the rather excessive prices charged by the carriers.

The Ministry of Posts and Telecommunications hopes to break this cultural roadblock with the PHP which is very much a cut-down cellular pocket-phone operating as a two-way Telepoint in the 1900MHz band. So Japan may actually benefit from the image of PHP being 'inferior' to PDC. The 'Handiphone' is not something any self-respecting executive would have — so now the subordinate Japanese can buy them in their millions.

The Ministry expects to see 10 million PHP handsets sold in Japan in the next half-decade, and they've already made a sale of the system to Hong Kong. The specs available make PHP appear to be a cross between DECT and DCS-1800; they've got the ADPCM voice coder and ping-pong transmission of DECT, but the narrow carrier and more limited slots of DCS-1800. It is obviously aimed at the same market as CT-2 Plus — home, small-office, and outdoors two-way Telepoint.

Stewart Fist is a freelance journalist based in Lindfield, NSW.



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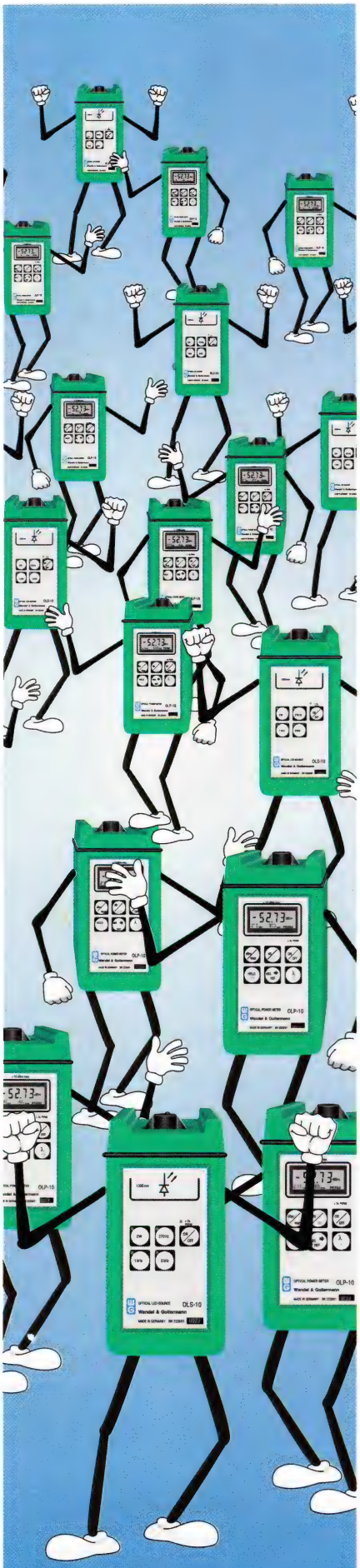

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Dial-Up Routers: Performance Falls Short of Promise

Dial-up routing may be an idea whose time has come, but the Data Comm Test Lab's examination shows that the products currently available often fall short of matching their promise.

The Thomas Edison formula pegs genius as being 1% inspiration and 99% perspiration. Makers of dial-up routers have the 1% down pat, but they still have a few details to sweat out to get their products into the networking hall of fame.

That's the main conclusion from this month's Data Comm Test Lab evaluation of dial-up routers. These entry-level boxes offer a network lifeline for small, remote offices that don't have enough traffic to justify the expense of a leased line but that still need to communicate with the rest of the enterprise.

This basic networking need has spurred internetworking vendors to create products that merge existing router technology with today's front-running dial-up products and services, including high-speed modems and switched digital circuits. The resulting hybrids are supposed to be cost-effective, reliable, and above all simple to use — key requirements given the fact that these products are most likely to be deployed in places where network managers don't often tread.

Unfortunately, right now most dial-up routers fall far short on the ease-of-use metric, a weakness that can be especially glaring in remote offices. In evaluating dial-up products from a selection of vendors, we found configuration to be a nightmare. In addition to the usual laundry list of router setup questions, dial-up products present a whole new class of issues related to switched circuits — issues made even murkier by uncommonly unclear configuration routines. In fact, setting up our very simple test bed — two LANs linked over a switched WAN circuit — proved tricky enough in some cases to take two days for products to be configured properly, even by vendor representatives. Two locally-developed products, the OpenRouter ELF from Datacraft and the ACE Outer Router from Interlink, have also been included in the table of features starting on page 92, but were not evaluated by the Data Comm Test Lab as part of this round of tests.

Low End, Not Low Rent

To be fair to manufacturers, dial-up routers are a lot more complicated than the low-rent, stripped-down offerings that constitute most entry-level product lines. Makers of dial-up routers must deal with a number of concerns that do not affect leased-line devices. For instance, protocol spoofing — a means of keeping LAN overhead traffic off WAN links — may be helpful for routers connected by low-speed leased lines, but it is absolutely essential for dial-up environments. Without spoofing, routers would be looking to broadcast LAN protocol information on almost a second-by-second basis, defeating the purpose of using dial-up links for occasional transmissions.

Dial-up routers, especially when they're set up to communicate over the public network's async lines, present a host of security problems that don't affect leased-line connections. And modem configuration, which by now one would expect to be second nature to networking vendors, proved to be a surprising problem in a couple of cases.

The Dial-Up Router Rundown

	Cayman Systems	Gandalf Technologies	Telebit
Product/Software Release	Gatoraccess MP/3.0.2	LANline 5225i/1.0.0	Netblazer 40/2.3
Processor	Intel 80386	Intel i960	Intel 80386
Memory (MB)	2	2	4
Footprint (cms)	29 by 41	20 by 27.5	42.5 by 42.5
Rack-mountable	No	No	No
Boot from diskette	No	No	Yes
Boot from flash PROM	Yes	Yes	No
Verify before reboot	No	Yes	Yes
Maximum RIP/SAP table entries	Memory limited, by typically 1,000	500 RIP, 500 SAP	Memory limited, but typically more than 2,000
LAN TECHNOLOGY			
LAN topologies	Ethernet	Ethernet	Ethernet, Token Ring
Routing protocols	IP, IPX	None (device acts as bridge)	IP, IPX, AppleTalk
Transparent bridging	No	Yes	No
Source route bridging	Not applicable	Not applicable	No
Maximum LAN ports	1	1	3
Modular LAN interfaces	No	AUI; 10Base-T/BNC optional	Yes
LAN connector types	AUI, BNC, RJ-45	10Base-T, AUI, BNC	Ethernet: AUI, 10Base-T, BNC; TR: DB-9, RJ-45
Autosense media	No; dip switches on back panel	Yes	Only with SMC Ethernet card
Filters	MAC, SAP, RIP, custom	MAC, NetBIOS name, SNAP	SAP, RIP, SNAP, IP source/ dest. address, IP socket
WAN TECHNOLOGY			
WAN topologies	PSTN	Synchronous switched digital at up to E1, dedicated	PSTN, ISDN, switched
Maximum WAN ports	30	2	34 async or 10 sync
Modular WAN interfaces	Yes	No	Yes
Internal modem	No	No	No
PAP support	Yes	No	No
CHAP support	Yes	No	No
SPOOFING			
Types of traffic sent	RIP, SAP, IPX keep-alive	IPX; RIP, SAP, keep-alive	IPX: RIP, SAP, Keep-alive
Automatic updates	Yes	Yes	Yes
Periodic updates	Yes	No	Yes
CONFIGURATION/MANAGEMENT			
In-band management: Telnet	Yes	Yes	Yes
In-band management:SNMP	Yes (get)	Yes	Yes
In-band management: Proprietary	X-Windows, ASCII terminal	Gandalf SNMP-compliant	Yes
Out-of-band management	Yes	Yes	Yes
Must user open box to change settings?	No	Yes	Depends on card vendor

3Com	Interlink Communications	Datacraft
AccessBuilder/TR 3.3; Ethernet 4.05	Outer Router/6.2	OpenRouter ELF/ 4.6
Intel i960	Motorola 68360	68030
4	2	4
30 by 42.5	10 by 16	Information not provided
Yes	Yes	No
No	No	Yes
Yes	Yes	Yes (Q4 1994)
Yes	Yes	Yes
Memory limited, but typically in excess of 2,000	Memory limited in excess of 2,000	In excess of 2,000
Ethernet, Token Ring	Ethernet	Ethernet, Token Ring
IP, IPX	IP, IPX, DECnet, AppleTalk	IP, IPX,OSI,AppleTalk
Yes	Yes	Yes
Yes	Yes	Yes
1	5	1/3
Yes	Yes	Yes
Ethernet: 10Base-T, AUI, BNC; TR, DB-9, RJ-45	10Base-T, AUI	AUI, BNC, DB9 (TR)
No	Yes	Yes
MAC, SAP, RIP, Custom	MAC, SAP, RIP	MAC, SAP, RIP, custom
PSTN, ISDN, switched, E1	ISDN (BRI or PRI), Sync switched	ISDN (BRI or PRI), PSTN, fractional E1, frame relay, X.25, Fastpac
16	4	1
Yes	Yes	Yes
No	Integrated ISDN	Integrated ISDN
Yes	Yes	Yes
Yes	Yes	Yes
IPX: RIP, SAP, keep-alive	IPX, IP, RIP, SAP, keep-alive	IPX, IP, RIP, SAP, keep-alive
Yes	Yes	Yes
Triggered by config. changes	Yes	Yes
No	Yes	Yes
Yes	Yes	Yes
No	Yes with CASST	Yes
Yes	Yes	Yes
No	No	No

Despite recurring difficulties with some products in our test lineup, we did find things to like about dial-up routers across the board. For example, all the products spoofed network traffic exactly as advertised. In addition, many products will dynamically set up and tear down extra WAN lines according to usage, making these true bandwidth-on-demand devices.

Overall, however, the drawbacks outnumbered the benefits. For instance, most products tested handle a very limited universe of routing protocols — typically just IP and IPX. More seriously, we were unable to configure most products as either transparent or source route bridges. That is an especially troubling shortcoming for organisations with unroutable SNA, NetBIOS, or DEC LAT (Local Area Transport) traffic. In essence, these folks are out of luck when it comes to some local area network interconnect products.

There was a notable exception to our findings. The Netblazer 40 from Telebit earned our Tester's Choice Award for its good straightforward setup routines, remote management capabilities, and extensive feature set. Honourable mention goes to the LANline 5225i from Gandalf Technologies. While it's actually a dial-up *bridge*, the Gandalf product merits inclusion because it performs IPX spoofing.

What is It?

Dial-up routing has actually been around for a while — but only as a backup for dedicated lines. It's one thing for a dial-up line to act as an emergency stopgap against network downtime, however, and quite another to rely on dial-up lines as a primary communications method. In the latter instance, dial-up devices must support a variety of WAN connection types, and they must be able to set up and tear down switched circuits easily and continuously, as traffic warrants.

In terms of connection types, the available WAN methods include async modems, switched digital, frame relay, and ISDN interfaces. Having all these choices is a good thing for network managers, but it does make equitable across-the-board performance comparisons virtually impossible. For instance, when it comes to async communications, some products have built-in V.32*bis* (14.4Kbps) modems, while others can use external V.fast (28.8Kbps) modems. Since the modem is such an integral part of performance at low speeds — and since modem support lists vary so widely, no fair comparison on performance could be made.

For these reasons, among others, we decided to focus our evaluation on qualitative factors, the most important being ease of operation and management, rather than raw performance measurements (see 'Test Methodology' on page 98). Rather than the usual charts and graphs, this evaluation

The Dial-Up Router Rundown (Cont.)

	Cayman Systems	Gandalf Technologies	Telebit
Product	Gatoraccess MP	LANline 5225i	Netblazer 40
RPL	No	No	No
BOOTP	Yes	No	Yes
Software upgrade method	TFTP from Unix or DOS, telnet	Serial port	Disk, FTP
Levels of passwords	Administrator	Administrator	System/configuration, system (read-only), user
RMON support	No	No	No
SNMP MIB II	Yes	Yes	Yes
Enterprise MIB agents	No	Yes	Yes
BANDWIDTH MANAGEMENT			
Session log	No	No	Yes
Monitoring of dial-up utilisation	Yes	Yes	Via syslog or SNMP
High usage warning	No	In log file	Via SNMP
Define bandwidth thresholds	Yes	Yes	Yes
Call scheduling	Unix cron	No; does allow time of day scheduling for calls	Yes
Callback capability	Yes	N/A; has caller ID	Yes
What triggers connection?	Packet, dial command	Bandwidth on demand; time of day; excess utilization	Data to send
Default link time (seconds)	0, but can be up to 4 hours	900 (range is 60 to 5940)	180
Auto bandwidth on demand	Yes	Yes	Yes
What terminates connection	No activity for up to 4 hours	Empty pipe; scheduler; console	Timeout — no user action
Automatic hang-up	Yes	Yes	Yes
Diagnostic tools	Yes	No	Syslog, line traces, interface traces

AUI = Attachment Unit Interface FTP = File Transfer Package PAP = Password Authentication Protocol RIP = Routing Information Protocol

focuses on an extensive listing of device features and functions (see Table 1). This time out, we evaluated the depth and clarity of the documentation included with each product — an important area, we felt, given these products' branch-office orientation.

Unease of Use

Most of the snags we ran into in our evaluation had to do with configuration issues. Our list of woes included modem compatibility problems, WAN port configuration difficulties, and, in the case of AccessBuilder from 3Com, a fundamental design limitation. (The AccessBuilder originated at Centrum Communications Associates, — which was recently acquired by 3Com and now is known as 3Com's Personal Office Division.)

Async modems are supposedly commodity products: as long as they're Hayes-compatible, they *should* work with any device, including dial-up routers, that accommodate external modems. As we found out in our run-throughs, however, this isn't always the case. In several instances, routers wouldn't communicate with external modems until the routers' modem configuration files either were rewritten from scratch or extensively customised.

Considering the hundreds of modems on the market, prospective buyers of dial-up routers would do well to ask vendors or resellers for a complete list of supported modems. Some router makers say they'll write custom scripts for modems not on their lists; these vendors include Cayman Systems and 3Com.

But sending the right commands to the modem is only part of the configuration picture — the router also has specific configuration requirements for dial-up communications. These proved to be the trickiest part of our evaluation. In several cases, critical information about WAN ports was scattered across multiple communications menus. For example, one menu might be used to enable a WAN port and set physical characteristics like line speed, but assigning a specific IP address to that port would require finding another command buried in a different menu. We found the configuration menus for Gatoraccess MP from Cayman and AccessBuilder from 3Com to be particularly unclear.

AccessBuilder has a design quirk that complicates WAN port setup beyond configuration. When setting up pairs of AccessBuilders, one router must be designated and set up as a call initiator, and the other as a call receiver. This puts obvious restrictions on traffic flows. Even if the call receiver has data to pass along, it must wait for contact from the call initiator to do so. If no traffic is forthcoming from the initiator's side, the receiver side must wait for scheduled update calls (such as those used for spoofing) to send its data. The only exception to this restriction occurs after a system reboot, when AccessBuilders automatically place calls to their partners, regardless of their status as initiator or receiver.

3Com	Interlink Communications	Datacraft
AccessBuilder	Outer Router	OpenRouter ELF
Yes	Yes	Yes
Yes	No	Yes
Flash, FTP, Xmodem	Flash, FTP	Disk, downline
SU, administrator, user	5 levels	User, administrator
No	No	No
Yes	Yes	Yes
Yes	Yes	Yes
Via SNMP	Yes	Yes
Via SNMP	Yes	Yes, SNMP
Via SNMP	No	Yes (Q4 1994)
Predefined algorithm	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Data to send, scheduled call	Time/Protocol/Product Type/Congestion	Data, schedules, packet
0	Yes — configurable	Configurable
Yes	Yes	Yes
Forced hang-up, inactivity timeout	No traffic, time	Time out, forced
Yes	Yes	Yes
SNMP, statistics, error log	Yes	SNMP, diagnostic monitor

MAC = Media access control SAP = Service advertising protocol TFTP = Trivial File Transfer Protocol

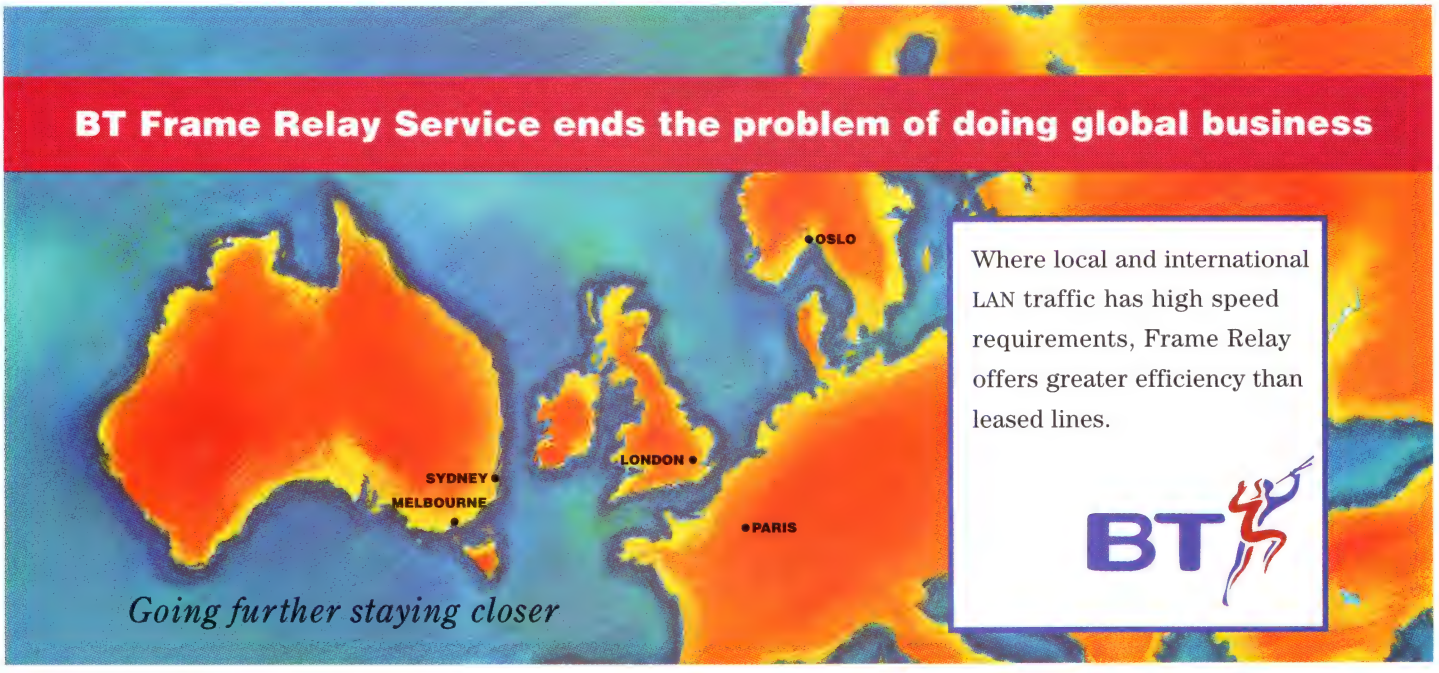
Spoofing Required

While ease of use is crucial for the deployment of dial-up routers in remote branch offices, protocol spoofing is an absolute requirement in terms of cost-effectiveness. Some LAN protocols send overhead traffic often enough to keep the link up indefinitely; without a way to keep overhead to a minimum, users may as well pony up for leased-line connections.

The LAN protocol most notorious for conspicuous consumption of bandwidth is IPX. Left alone, NetWare's routing protocol is spectacularly inefficient over WAN lines. What's more, NetWare sends SAP (Service Advertising Protocol) broadcasts and session keep-alive packets every 30 to 60 seconds to all segments in an internetwork. In addition, IPX routers send RIP (routing information protocol) packets among themselves every 30 seconds to maintain a current picture of the internetwork. With all this broadcast traffic, it's possible that switched WAN links would never be torn down — which defeats the point of using dial-up links.

To prevent this from happening, all routers we tested spoof key types of overhead traffic — that is, they keep retransmitting data about the other side of the network to local stations, even after the WAN circuit has been disconnected. This spoofing preserves the integrity of the session riding on top of the LAN protocol without requiring constant communication to be maintained over the wide area.

In the case of IPX, three types of traffic need to be spoofed: SAP, RIP, and keep-alive (or 'watchdog') frames. SAP frames show the availability of devices like servers, printers, or routers throughout as internetwork. In the SAP process, a workstation



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Price Waterhouse

broadcasts a SAP request frame seeking information about available services. Each service (such as a server or printer) then responds to the request with a SAP reply frame. Each service also periodically broadcasts SAP requests of its own. The more services in an internetwork, the more bogged down the WAN will become with SAP replies.

IPX RIP frames, issued by NetWare routers, inform other routers of available paths in an internetwork. Again, the greater the number of routers that exist in an internetwork, the more RIP frames will be propagated throughout the internetwork.

Watchdog frames are perhaps the most critical traffic of all, since they maintain the session between remote clients and servers. When NetWare clients log into a server, they become 'attached,' or virtually connected, to the server. The concept of a virtual rather than a physical connection is important, since NetWare users typically end their sessions by powering off their PCs rather than logging out. NetWare servers accommodate these users by sending out watchdog frames and then terminating the attachments of stations that don't respond.

Without some way of acknowledging the server's watchdog frames, NetWare sessions cannot be maintained. Spoofing takes care of this for dial-up routers by repeating watchdog frames to local clients and acknowledgments to local servers, even after the WAN link is down.

Spoof Tests

For each router evaluated, we tested spoofing capabilities by monitoring NetWare traffic after the WAN link was torn down. Sure enough, all products in the test proved capable of rebroadcasting locally the IPX SAP, RIP, and keep-alive frames that normally would have come from the remote source.

Local re-broadcasting is what represents the baseline requirement for effective protocol spoofing because it means dial-up lines can in fact be torn down. Another part of spoofing involves exactly when and how changes made on one side of the link are reported to the other side.

All vendors involved in our tests say their dial-up routers will initiate calls to their remote partners whenever local changes are made, such as a client's logging out of a NetWare session. (The obvious exception is a 3Com AccessBuilder set up to receive calls only.) Although we didn't formally test this procedure for all products, during the course of our evaluations, whenever we made changes on one side of the test bed, the router on that side did initiate a call to its partner.

With the exception of Gandalf's product, all routers tested allow network managers to set filters that prevent locally generated RIP and SAP messages from triggering calls. Although this approach means remote sites aren't kept quite up to date on local network status, filtering could be a key tool for minimising WAN use in networks characterised by frequent changes, particularly in client status.

As an adjunct to filtering, dial-up routers can also be programmed to initiate calls at regular intervals in order to exchange updated network information. (Network updates also are exchanged every time the routers dial in to send data.) All the products tested except Cayman's have an internal call scheduling capability, which allows network managers to decide how often these updates are sent to remote sites. Cayman's Gatoraccess MP does allow scheduling, but only with external Unix Cron commands.

The complexity of spoofing issues like RIP and SAP filtering warrants a closer look than the scope of this evaluation allowed. *Australian Communications* plans to present an in-depth analysis of this issue — the first of its kind — in a future edition.

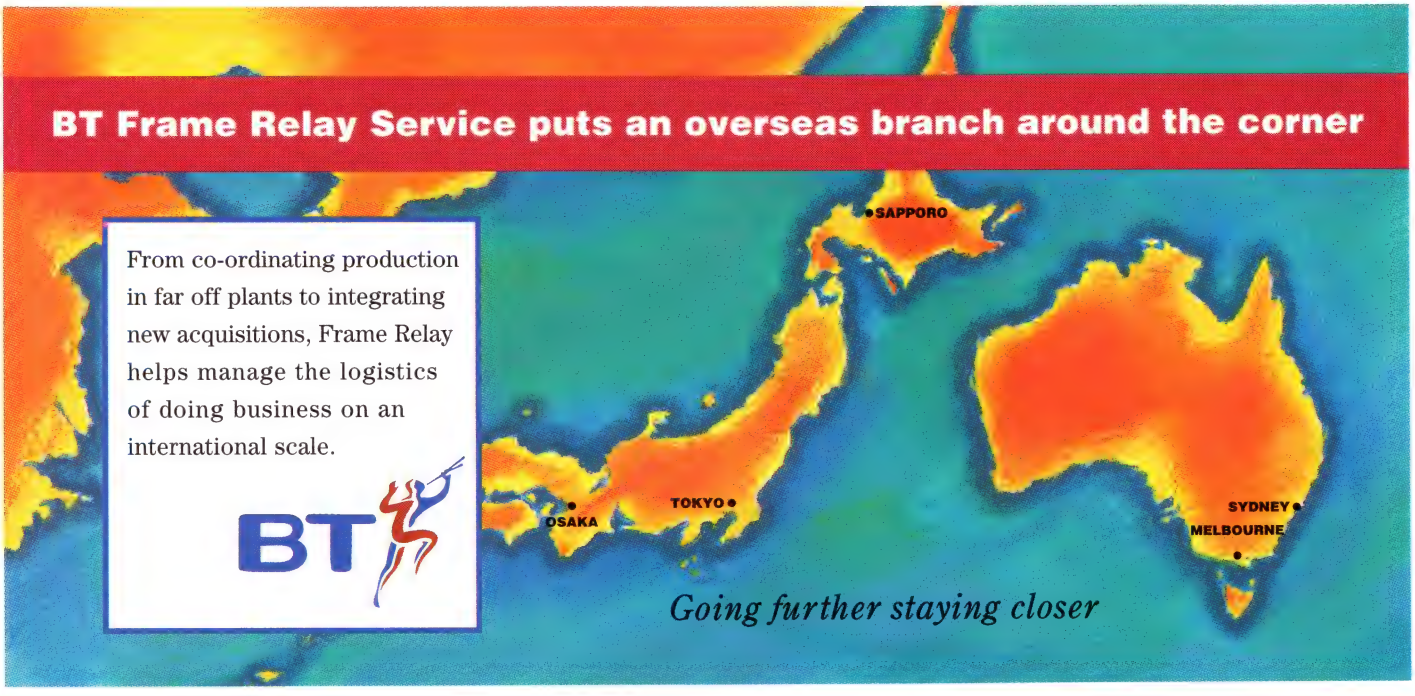
Security Issues

The beauty of dial-up routing is that it can work over conventional dial-up lines — provided async WAN cards and modems are in place. Of course, that's also an inherent danger, since it means routers can be accessed by anyone on the public network. For this reason, access control is a major priority for dial-up routers.

The products we tested offer varying levels of protection against intruders. All six devices protect entry to the management port by requiring a password upon connection, but that's only a rudimentary safeguard. Several vendors supplied devices that had easily guessed log-in names, such as ROOT or SU, and no password as their default settings. All too often, network managers will not change log-in names or passwords, especially during a major installation, thus leaving the router open to unauthorised intruders.

WAN protection can be bolstered with a callback capability. Under this protection scheme, the router asks for the caller's phone number, hangs up, and then returns the call if the number is on a list of authorised contacts. Several of the boxes we looked at offer this feature, but not Gandalf or 3Com. However, Gandalf says it supports caller-identification services where this facility is offered, though the lab did not verify this function.

Password protection and callback are hardly the last word in security, however. It's still possible to guess a password using



Test Methodology

The US-based Data Comm Test Lab counted ease of management and operation as the two main criteria in this test.

To judge both areas, the Test Lab configured a pair of each vendor's devices to link two LANs over a wide area network link. The LAN topologies were Ethernet and, where supported, Token Ring. On the WAN side, we configured the routers to communicate either asynchronously (using modems) or synchronously (using the equivalent of a switched connection). Asynchronous data circuits were emulated with MOD-35SW modem eliminators from VIR.

Our tests were not aimed at setting performance benchmarks; instead, we were interested in determining how easy or difficult it is to set up and use each vendor's products. We ran through several configurations, including two IP-only LAN segments linked over the wide area and two IPX-only segments. We also attempted to configure both segments as part of the same logical network, a capability which is not supported in some vendor's devices.

In addition to the participating US vendors, two local products have been included in the table of features starting on page 92. These products were not evaluated by the Data Comm Test Lab, and consequently are not mentioned in the body of the article.

algorithms that attempt many possible combinations of characters, and rogue software can be used to fool callback systems into believing they're connected with an authorised number. What's needed is a way to authenticate the routers themselves across the WAN. Such a scheme is offered by two methods developed by the IETF — the password authentication protocol (PAP) and the challenge handshake authentication protocol (CHAP). PAP and CHAP, both subsets of the point-to-point protocol (PPP), are defined in RFC 1334.

PAP performs a one-time authentication process. Once two routers are connected, the router initiating the call repeatedly sends a password and an identification code to the receiver. The receiver must either acknowledge the password and ID or break the connection. But PAP doesn't encrypt the ID and password, leaving both open to interception. CHAP, in contrast, encrypts both password and router ID. What's more, CHAP repeats the verification process periodically, each time using a different ID value. The CHAP algorithm calculates ID values based on a verification method known only to the caller and receiver.

PAP is a useful starting point for network managers who want to get serious about remote-access security. But CHAP is considerably more robust, not only because of its use of encryption and repeated security challenges but also because the *receiver* controls the authentication process. This means network managers can examine challenge and response frames at the central site — a capability not offered by PAP. Of the vendors in this test, Cayman and 3Com offer PAP and CHAP support; Gandalf and Telebit do not.

Caution: Bridge Out

In addition to testing configuration routines, we also took a long look at each product's features and functions. One of the most important, and most disappointing, areas we investigated was bridging — or, more appropriately, the lack of bridging.

We expected these low-end products to handle relatively few routing protocols, but we were surprised to find that some don't support bridging of any kind — an omission that all but rules out these products for sites with unroutable traffic, such as SNA, NetBIOS, or LAT traffic.

Failure to support bridging also means single segments can't be defined across the wide area, as required by some applications. For example, a dial-up router couldn't be used with a NetWare-to-SNA gateway at the remote site, since the host protocol — Logical Link Control 2 (LLC2) carrying SNA — can't be bridged over the wide area. For this scenario, network managers would have to deploy the gateway at the central site and then route IP or IPX over the WAN — an approach that's usually less efficient.

On the Ethernet side, transparent bridging is available from Gandalf and 3Com. Only 3Com supports the source route bridge used on Token Ring LANs.

Vendors do a much better job on the WAN side, where numerous connection types are available. Like other kinds of remote-access devices, most dial-up routers handle both synchronous and asynchronous communications. Telebit and 3Com allow sync and async interfaces to be combined in the same chassis.

Most vendors offer several models of their dial-up routers, with varying numbers of LAN and WAN interfaces. Routers with multiple WAN interfaces give network managers the ability to dynamically add or subtract bandwidth as needed. That's an important feature on a dial-up product, especially given the occasional nature of much branch-office traffic. Whenever more bandwidth is needed, the router simply sets up another call. Routers from Cayman, Gandalf, Telebit, and 3Com also allow traffic loads to be balanced over multiple WAN circuits, thus guarding against the possibility of any single line becoming overloaded.

Bandwidth Management

Given the low speed of switched circuits, dial-up routers must be able to make efficient use of WAN bandwidth. Vendors offer several ways of doing this. For example, Telebit and 3Com routers can send out alerts to SNMP network management systems, which in turn can be configured to sound alarms whenever traffic levels exceed the preset thresholds.

A number of other steps are available to vendors to ensure that bandwidth is used efficiently, including the following:

- *Session log*: A record of all calls and error messages helps network managers analyse usage patterns. The management software for Telebit's Netblazer includes a built-in session logging capability. Other vendors pass session log information to external applications or to an SNMP management console (a facility offered by Telebit and 3Com).
- *Bandwidth-on-demand thresholds*: All vendors in this evaluation except 3Com allow network managers to define the point at which additional WAN lines should be set up or torn down. Usually, these thresholds are given as a percentage of line utilisation; for example, a network manager could specify that a second line be set up once utilisation on the first line reaches 80%.
- *Definable default link time*: Dial-up routers set up a link to send data — but what happens after the data has been sent? All the routers in the test have definable inactivity timers that break a connection when there's no data to be sent.

As they deploy dial-up routers, network managers face a critical question: how will the boxes communicate with other devices in the enterprise?

Eventually, PPP will serve as the unifying link in router-to-router communications over the WAN. PPP, most recently updated by the IETF in Request for Comment (RFC) 1548, theoretically allows any two devices to communicate over a serial link. At this point, however, at lest two issues may prevent devices from using PPP to achieve interoperability.

The first is a general lack of uniformity in PPP implementations. All three parts of the PPP spec — encapsulation, link-layer negotiation, and protocol identification — allow considerable flexibility in implementation. what's more, PPP allows protocol-specific extensions to be used; these too vary by implementation. These variations mean pairs of devices that successfully use PPP for one protocol may not work with another protocol.

The second obstacle to PPP interoperability is more basic — only a few central-

site routers, if any, offer asynchronous interfaces with their products. Thus, dial-up routers that use async lines must be deployed in pairs. As noted earlier, several vendors do sell synchronous interfaces for their dial-up products, including Gandalf, Telebit and 3Com. Fortunately, vendors are getting closer to widespread PPP interoperability — but it's still difficult to assign blame when a connection can't be made.

Network Management

Dial-up routing, in essence, is about putting networking equipment where network managers aren't — this means products need strong remote management and control capabilities. Given the large number of configuration problems we encountered during this test, we assumed vendors would offer several methods of complete remote control. Unfortunately, that wasn't always the case.

On the positive side, all vendors accommodate out-of-band management through a serial port, and all except 3Com allow remote configuration through the TCP/IP Telnet application. Further, all vendors in the test allow software upgrades to be downloaded using TCP/IP's FTP (file transfer protocol) application. And several suppliers — Cayman, Telebit, and 3Com — support BOOTP, an application that automatically gathers configuration information from stations on a TCP/IP network.

But some remote-access routines don't given the caller the same information a local user would see. For example, Cayman System's Gatoraccess uses connection scripts that expect a particular connection string — but the string isn't displayed to a network manager calling in from a remote site.

In terms of standards-based network management, all products in the test offer the SNMP management information base II (MIB II) for routers, which reports a limited amount of status information to a central SNMP management station. Enterprise MIBs, which are proprietary extensions to the MIB II spec, are supported by Gandalf, Telebit and 3Com. None of the vendors offer the remote monitoring MIB (RMON MIB), a set of Ethernet and Token Ring-specific monitoring tools.

Required Reading

Along with evaluating specific product features, we pored through each product's documentation, with two criteria in mind. First, we wanted to see whether the level clarity and detail in the documentation was appropriate for non-technical users, such as those most likely to be deploying these products in remote offices. Second, we checked to see what sorts of help the vendor offered users in the way of quick reference cards, flow charts, diagrams, and the like. We found both Telebit and 3Com supplied good documentation, with extensive command references, management guides, and quick reference cards.

Cayman Systems

Cayman's Gatoraccess MP (Australian distributor: ADE Network Technology (03) 543 2677) is really a communications server that can perform dial-up routing. As such, Gatoraccess is more difficult to configure and use as a router than the other devices — a situation not helped by its lack of an integrated menu-based configuration utility. The menu was so tricky, in fact, that we were unable to achieve IPX connectivity with the vendor.

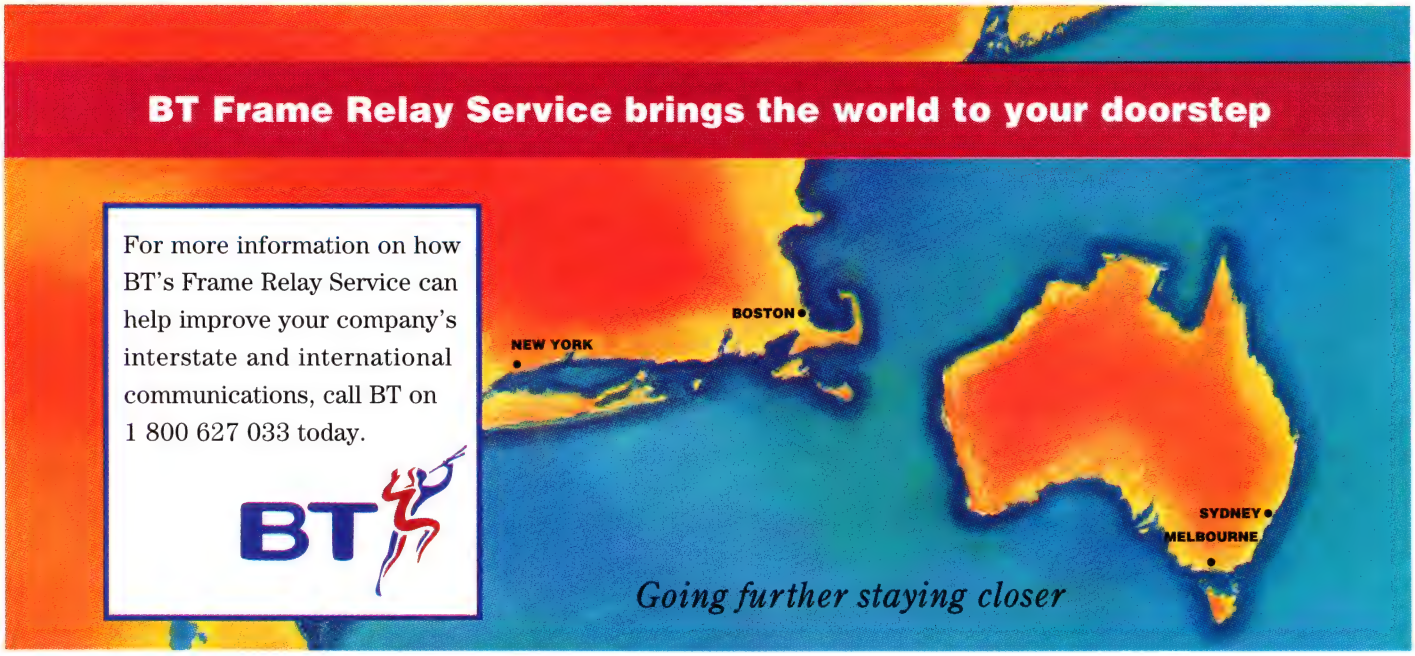
On the positive side, the Cayman router can handle up to 30 async connections, making it a suitable device for both LAN-to-LAN and individual-to-LAN connectivity. Supported WAN protocols include PPP, SLIP (serial-line IP), and CSLIP (compressed SLIP). The vendor says the router works with a long list of modems from leading vendors. Getting the router to work at all, however, isn't a simple task. Gatoraccess can be configured from Cayman's X-Windows management application — but for network managers working from a serial port interface, the view of the router isn't a pretty one. The router's command-line configuration, which resembles a cross between Unix and DOS, was very rough going.

Further, we also found some shortcomings in the device's feature list, most notably lack of support for bridging. In addition, the Ethernet-only Gatoraccess doesn't support the AppleTalk protocol or the Ethernet SNAP (subnetwork area protocol) packets used by Apple Macintoshes — both surprising omissions from a vendor that made its name with Apple networking products.

Gandalf Technologies

Gandalf's LANline 5225i (Australian distributors: CTEC (02) 975 4722 and Infotron Systems (02) 417 7366) is really a dial-up bridge, not a router. Obviously, that means the LANline can't make network layer decisions — but it does do just about everything else needed to link LANs over dial-up lines. Among the many features it supports are bandwidth on demand, call initiation based on IP or IPX addresses, IPX spoofing, and data compression.

The LANline 5225i we tested had one Ethernet LAN and two V.35 WAN ports for high-speed connections over switched synchronous digital lines. Alternatively, network managers can choose EIA-232 WAN ports for use with async modems (the Lab didn't evaluate these async connections,



however). The vendor also makes another model, the LANline 5240i, with built-in terminal adaptors for connections over an ISDN basic-rate interface. Whatever the WAN flavour, the bridge allows the second port to be used either as a second 'pipe' or as an interface for out-of-band management.

The LANline was relatively easy to configure and use. The configuration utility offers several ways to set up calls, such as time of day and IP or IPX destination address, and it's possible to set the threshold at which the second WAN port should be opened. One feature we especially liked was that configuration changes take place immediately, without the need for a reboot; Gandalf was the only vendor with this feature.

The LANline's data compression was adequate but not stellar. Transferring 1MB files over a 56Kbps circuit, we achieved compression ratios of 2.4:1 when using text and about 1.8:1 when sending executable data — as compared with ratios as high as 7:1 for other Ethernet bridges.

But Gandalf was the only vendor in this test to perform compression over synchronous lines.

Telebit

Telebit's Netblazer (Australian distributor: Dataplex (03) 210 3333) was easy to install and configure, and goes several steps beyond other products in terms of suitability for use in large networks: it routes IP, IPX and AppleTalk over Ethernet and Token Ring networks, and its WAN options include async modems, switched digital circuits, and ISDN. About the only drawback we found was a lack of support for bridging of any kind — a surprising omission in a product otherwise so well suited for use over the enterprise.

We tested Telebit's Netblazer 40, a high-end model that can handle up to three LAN and 10 sync or 34 async WAN connections. Other Netblazer models can support fewer ports, including the low-end Netblazer PN, which offers one LAN and one WAN interface. We tested Netblazer 40 with a pair of the vendor's T3000 external V.42*bis* modems; external modem-polling devices are available, as are internal modems.

All Netblazers come with two versions of the vendor's configuration software: one package runs under Microsoft Windows, while the other uses a command-line interface that combines elements of DOS and Unix. We found both versions to be extremely easy to use. With the Windows program, for example, we were able to set up IP and IPX links in less than 20 minutes — a feat assisted by the software's automatic detection of NetWare network numbers. The command-line interface was equally impressive; navigation among commands was easy despite the richness of the menus.

3Com

3Com's new AccessBuilder (distributed by 3Com ANZA (02) 959 3020) is just one configuration program away from matching Telebit's Netblazer feature for feature. Physically, the AccessBuilder is every bit as impressive as the other products: it supports Ethernet and Token Ring LANs, while its WAN options range from low-speed async to synchronous high-speed links. AccessBuilder even offers full support of transparent and source route bridging — a claim that no other vendor in this test can make.

Unfortunately, all those features are stunted by one of the most difficult — and flawed — management utilities we had to deal with. The product's menu-based configuration software is particularly tricky in that it almost, but not quite, resembles the Netbuilder software used by other 3Com routers. Network managers familiar with NetBuilder shortcuts are in for a few surprises with AccessBuilder. Perhaps this shortcoming is understandable considering 3Com only recently brought AccessBuilder into the fold via its purchase of Centrum. Unfortunately, however, it's not the only problem with this router's software.

A more critical flaw is the software's inability to flush dynamic routes from its memory. Normally, when routers establish connections, they remember RIP information by caching it in memory. When the memory becomes full, most routers dynamically clear, or flush, the memory of older routing entries to make more room. But the only way to flush memory with AccessBuilder is to delete *all* routing information, including configuration information for all LAN and WAN ports. In essence, this shortcoming forces network managers to rely on statistically defined routes — and that, in turn, restricts AccessBuilders to calling only predefined locations.

On the positive side, the AccessBuilder's bridging support allows it to handle many more kinds of network traffic than most other products in this test. The list of bridged protocols includes some that can't be routed, such as NetBEUI, and routable protocols including AppleTalk, DECnet, XNS, and Banyan Vines.

Kevin Tolly is director of the Data Comm Test Lab and President of The Tolly Group, based in New Jersey. David Newman is Testing Editor for Data Communications magazine, based New York. Wayne Schiller, as Research Associate with The Tolly Group, was Project Manager for this evaluation.

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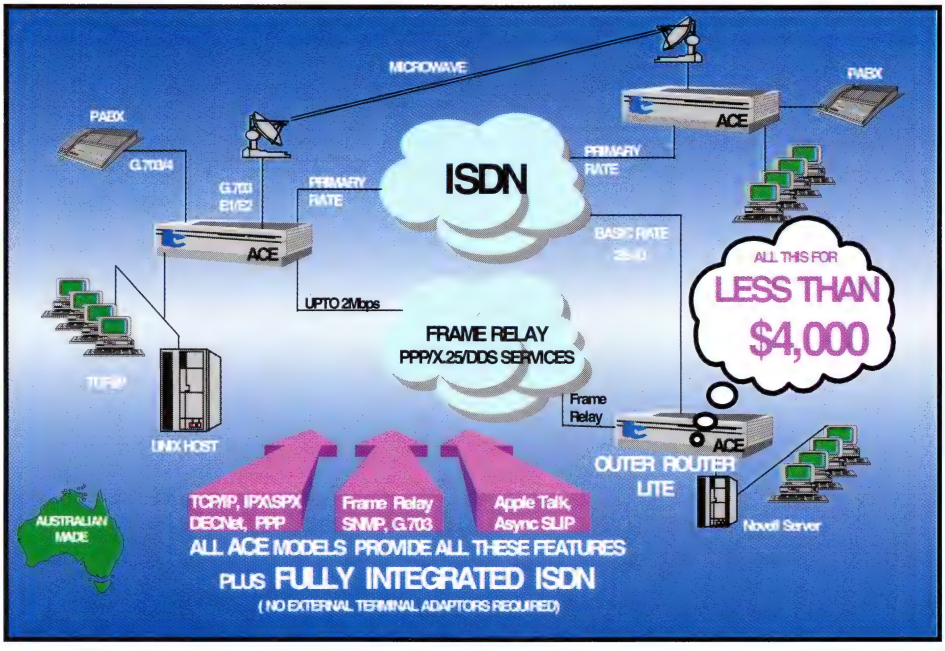

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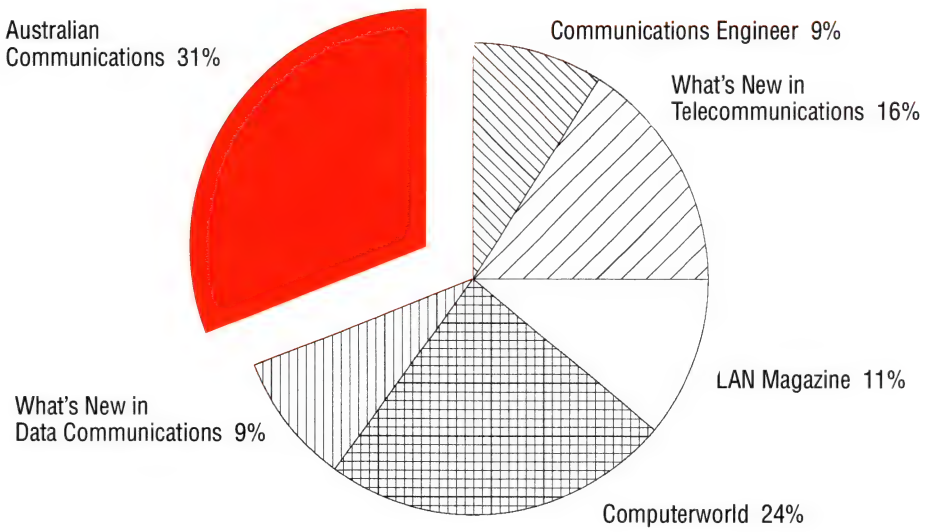

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Shifting SNA Onto a Global Router Backbone

Sweden's SKF took the giant leap to move mission-critical SNA data onto a router backbone, and now saves over $5 million each year while maintaining — or even improving — reliability and performance.

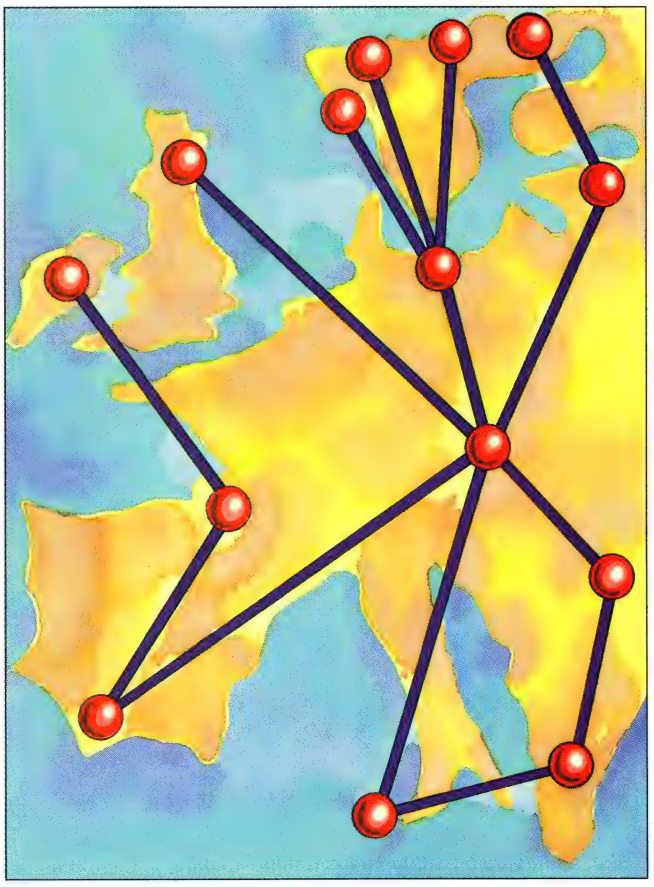
Assessing risks and evaluating opportunities is what business is all about — whether it's timing the entry into a new market or seizing the right moment to introduce new technologies onto the corporate network. For AB SKF, the world's largest manufacturer of bearings, one such moment came early in 1992, when it gave the green light to a ground-breaking redesign that would shut down three of five European data centres and replace its international SNA network with a router backbone. SKF, based in Gothenburg, Sweden, proceeded cautiously, but with a clear sense of purpose: moving mission-critical SNA traffic onto routers is not something to be undertaken lightly. In fact, the company had first considered data centre consolidation back in 1988, but the high price of digital leased lines and doubts about internetworking technology forced it to shelve its plans.

Three years later, though, it was another story. The Swedish manufacturer had been watching carefully as the cost of private circuits steadily dropped. And Group Telenet support, SKF's network design and management team, had kept a very close eye on emerging transport technologies. So when the company took its pioneering plunge, it was well prepared. And its groundwork paid off: SKF's consolidation effort is saving it a cool 30 million Swedish kronor (about $5.45 million) a year.

But there's more to SKF's success story than the bottom line: the company also has maintained — and in some cases improved — reliability and performance on its corporate network. These are both critical concerns, given that the redesign means that nearly 3,000 end-users now rely on the router backbone to access applications that once ran on local IBM mainframes. If the new backbone goes down, SKF employees and customers all across Europe would be cut off from inventory, production control and e-mail applications running on two remaining data centres in Sweden and Germany.

It was up to Toni Bergman, who heads Group Telenet Support, to spearhead the redesign. His five-person team evaluates and selects all enterprise hardware and software and publishes guide lines that ensure SKF companies worldwide use consistent standards and naming conventions. On this project, Bergman asked a member of his team, Thomas Johansson, to work with him on evaluating backbone technologies. Once routers had been chosen, Johansson took charge of technical planning, design, and installation of the backbone. Bergman remained in charge of overall planning and design and also served as liaison to the PTTs and service providers.

Bergman and Johansson knew they had their work cut out from the start. Europe's cross-border digital leased lines are notoriously unreliable, which meant that any technology they chose had to offer alternative paths around line failures. After assessing SKF's needs and the available options, the two came up with a short list of four candidates. They could stick with SDLC (synchronous data link control) but deploy a much higher-capacity network to accommodate the thousands of new users on the backbone. Channel extension was another possibility. They also could go with Token Ring bridges or multiprotocol routers.



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SKF Case Study Management Summary

Innovative networking is nothing new at AB SKF, which built one of Europe's first SNA backbones in the late 1970s to help shift its production and distribution from national to global markets.

Clearly, the Swedish organisation is doing something right: SKF is now the world's largest manufacturer of bearings and seals. The group comprises more than 150 companies in 40 countries, with a workforce of about 41,000. Sales in 1993 came in at 29.2 billion Swedish kronor (about $5.36 billion).

In 1992, SKF decided to radically redesign its corporate network shutting down three of five European data centres and shifting mission-critical SNA traffic onto an international router backbone. Doing so has resulted in net savings of SKr30 million (about $5.45 million) a year across the entire group. The project was handled by SKF Dataservice AB, a subsidiary that handles all of the manufacturer's computer and communications services.

The tremendous savings which were realised through SKF's data centre consolidation stem mainly from staff reductions and elimination of IBM's hefty software license fees. The leased lines and routers used on the new backbone cost somewhere in the vicinity of SKr5 million (around $900,000) annually, significantly more than the old SNA network. But that's still considered a small price to pay for the much higher capacity and redundant connections needed to maintain service quality.

SKF's Thomas Johansson (left) and Jan-Olov Wallander keep a watch on the backbone from a single screen

Router Reservations

Ironically, given their final choice, Bergman and Johansson were leery about routers at the start. Vendors had just started to roll out support for SNA networks — in the form of protocol prioritisation, flow control, and SDLC conversion. And they had strong doubts about whether routers could prevent bursty LAN protocols from disrupting SNA sessions.

What's more, IBM, which has a very close relationship with SKF, had warned the manufacturer against internetworking SNA traffic back in 1991, when Bergman was considering a backbone based on Token Ring bridges. But when IBM announced its 6611 in May 1992, Bergman and Johansson took it as an endorsement of the underlying principle of routing SNA traffic. Careful network design showed Johansson that he could keep LAN traffic off the backbone at first and then add it slowly while monitoring the results. (At this point, the backbone is 90% SNA, 9% DECnet, and 1% LAN traffic.)

Completing their assessment, Bergman and Johansson realised that routers would actually give SKF just what it needed, and they decided to buy equipment from Cisco Systems.

As with any new technology, there have been snags and setbacks, but SKF remains enthusiastic about the redesign, which was completed in December 1993. The manufacturer also is pleased with its router vendor. Although it had originally intended to use only five Cisco boxes, it's now deployed a total of 26 (mostly a mix of AGS+ routers and 3000/4000s, with one 7000).

That's not to suggest that everything's been smooth sailing: the company had to compromise on performance because Cisco's routers can't support all of SNA's flow control and prioritisation mechanisms. And although Cisco's gear has proven reliable, the vendor is poor at handling problems when they do occur.

For all the shortcomings, though, SKF has made it clear that faced with the same decisions it would make the same choices.

Redesigning the backbone has led to one other — unexpected — development. Johansson and Jan-Olov Wallander, another member of Bergman's team, now supervise the router network, while the staff in the remaining data centres oversee the access networks. According to Johansson, the router backbone requires far less maintenance than its SNA predecessor. On the rare occasions when software problems crop up, however, they can be tough to diagnose.

The Backbone, and Beyond

SKF's pan-European router backbone also features a link to the company's US Data Centre. Its data network, however, extends much farther afield, servicing more than 100 operating companies and 700 customers in 40 countries. Connections to Latin American and Asian Pacific countries are via X.25 networks from Sprint International, Unisource N.V. and PTTs.

Taken together, the applications running on SKF's private and public networks are known as Group Telenet. These are supported on 100 IBM 3090 mainframes and some 100 AS/400s and System/36s. Local access is over SDLC lines and Token Ring LANs via IBM 3174 gateways and PCs fitted with coax and Token Ring cards. Remote access is via X.25 and SDLC packet-switching services and leased lines.

The backbone also links the Ethernets that carry SKF's DECnet traffic, which mainly consists of requests to engineering databases and CAD/CAM file transfers. All in all, there are about 100 VAX minicomputers from DEC in various locations. SKF also has 11,000 dumb terminals and more than 40,000 PCs, and leases more than 300 private circuits.

Before the router backbone went into service, SKF operated a classic SNA network in Europe and the US. In fact, SKF built one of Europe's first SNA installations in 1978 to allow its factories to compete in the global rather than local marketplace.

SKF's original SDLC backbone linked five European data centres and a number of remote FEPs (see Figure 1 on page 106). It also connected Gothenburg with SKF's US data centre, which has SDLC links to production plants in South America. The IBM 3270 and IBM 3725 FEPs were tied to 9.6 or 19.2Kbps analogue lines fitted with modems and Datamizer data compression multiplexers from Symplex Communications. Each line supported four channels. On some routes, all four were used for SNA; on others, one carried DECnet traffic, which was shunted onto the backbone by DEC routers connected to the muxes.

SKF's consolidation plan blacked out the data centres in Clamart (France), Turin (Italy), and Luton (UK). The remaining IBM 3090 mainframes in Gothenburg and Schweinfurt, Germany, have been beefed up and repartitioned (see Figure 2 on page 107). Complete replicas of the software on the French and UK mainframes now run in Gothenburg; and a replica of the Italian software runs in Schweinfurt.

Each of the routers at sites where mainframes have been removed is connected to

two lines, one to Gothenburg and one to Schweinfurt. Thus, traffic can be diverted if a leased line fails — a common occurrence in Europe. Johansson says that SKF experiences about one outage a day.

Cisco AGS+ routers at larger sites are connected by digital leased lines equipped with Datamizer muxes. Bandwidth on these links ranges from 64 to 512Kbps. Cisco 3000/4000s at many of the smaller sites are tied to Gothenburg via a frame relay service from BT. The frame relay service also links Gothenburg to SKF's US data centre, where a Cisco 7000 has been installed. At present, SKF has eliminated FEPs at Luton, Saint Cyr (France), Milan, and two steelworks in Sweden, operated by Ovako AB (Hellefors), an SKF subsidiary. At other sites, the 3270 and 3725 FEPs have been replaced by 3745s.

Money Well Spent

SKF's router backbone has much higher operating costs than its SDLC network. That's partly because it employs higher-bandwidth lines to move more traffic and hold down delays. Redundant links, used to ensure reliability, also contribute to the steeper charges. Bergman budgeted SKr6.5 million (about $1.2 million) a year for the leased lines in the backbone's meshed core and another SKr250,000 (about $45,500) a year for the routers.

As far as SKF is concerned, the money is well spent. With the new backbone in place it was free to consolidate data centres, which resulted in huge savings. According to Bergman, most of this money comes from staff reductions and elimination of IBM's hefty licence fees for mainframe software.

Before actually building the backbone, Bergman invited four operators to bid on outsourcing the entire project: AT&T, BT, Infonet Services Corporation, and Sprint International. Their prices ranged from SKr6.5 million (about $1.18 million) to SKr10 million (about $1.82 million) a year, with the lowest bid based on frame relay. Bergman determined that with data compression he could cut line costs to SKr4.7 million (about $0.85 million) and decided against outsourcing.

But there was more than money behind Bergman's decision. Frame relay was just getting established, and he comments, "We didn't dare use it" for the meshed core. Nevertheless, SKF did end up going with frame relay to link smaller sites.

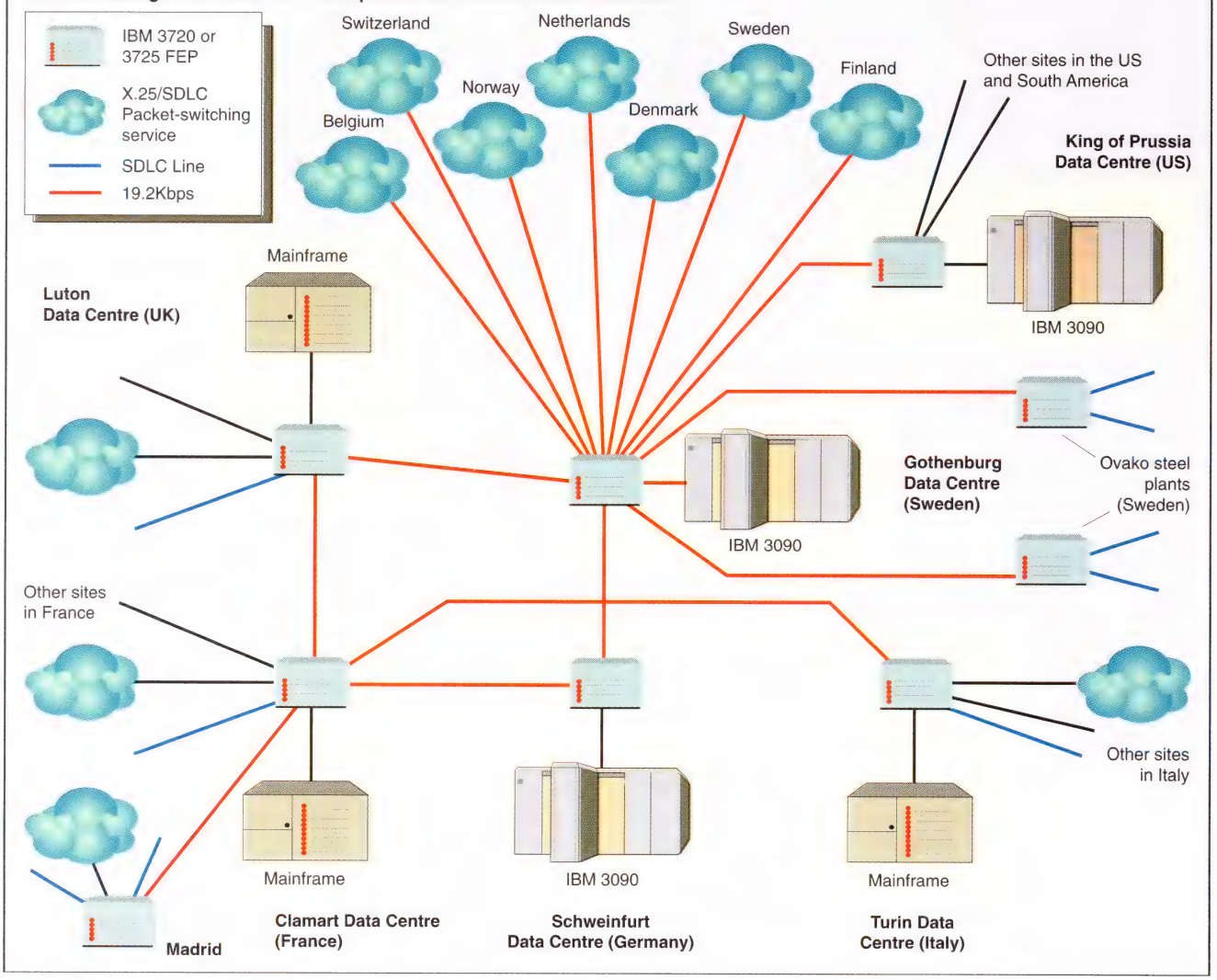
Making The List

When Bergman and Johansson set out to evaluate possible technologies for the new backbone, they knew very little about routers. And what they did know was unsettling. "We really didn't trust routers at that stage," Johansson says, noting that support for SNA was in its infancy.

Rather than ruling out routers entirely, though, Bergman and Johansson drew up a list of requirements for any technology that SKF would consider using on its backbone (see the table on page 113). They then rated multiprotocol routers along with three other

Figure 1: An SNA Backbone by the Book

SKF deployed its original SNA backbone in 1978. By 1992 the network linked five European data centres and a number of remote FEPs. It also tied Gothenburg to a US data centre and production facilities in South America.



possibilities — revamped, higher-capacity SDLC; channel extension using equipment from Network Systems Corporation; and Token Ring bridges from Olicom.

The ability to divert traffic automatically around line failures was far and away the most important concern. Routers, or more specifically IP backbones, had a clear advantage on this score because they divert traffic back onto its original path once a line is restored. Channel extension can do the same thing, but Bergman and Johansson felt that the equipment was prohibitively expensive. SDLC line failures, in contrast, result in lost sessions. And even though IBM NetView lets administrators automate periodic attempts to restore sessions on failed lines, Johansson says keeping this program up-to-date can be a major task on a big network.

Token Ring bridges also keep sessions alive if the link fails, but they need FEPs to do so. Further, they can't put traffic back onto the original path when a line is restored, which means that personnel must keep a fairly close watch on traffic flow if the backbone is to be used efficiently.

Bergman and Johansson discovered that routers offered other solid advantages. For one thing, the technology gave SKF a way to add LAN traffic onto the backbone while prioritising SNA packets by routing different protocols to different ports (see 'Making Protocols a Priority' on page 110).

Channel extension and Token Ring bridges also accommodate multiple protocols, but they offer no prioritisation. SDLC was strictly an SNA-only affair.

Further, a router's ability to assign different protocols to various ports also gave Johansson a way to balance loads on the backbone — albeit to a limited extent — by shunting SNA onto primary routes and DECnet onto secondary routes.

Here again, channel extension can be used to achieve the same end, but at a price SKF was unwilling to pay.

Finally, SDLC meant shelling out for very expensive high-speed interfaces to the FEPs. In fact, a high-speed FEP interface costs almost as much as an entire router, according to Johansson.

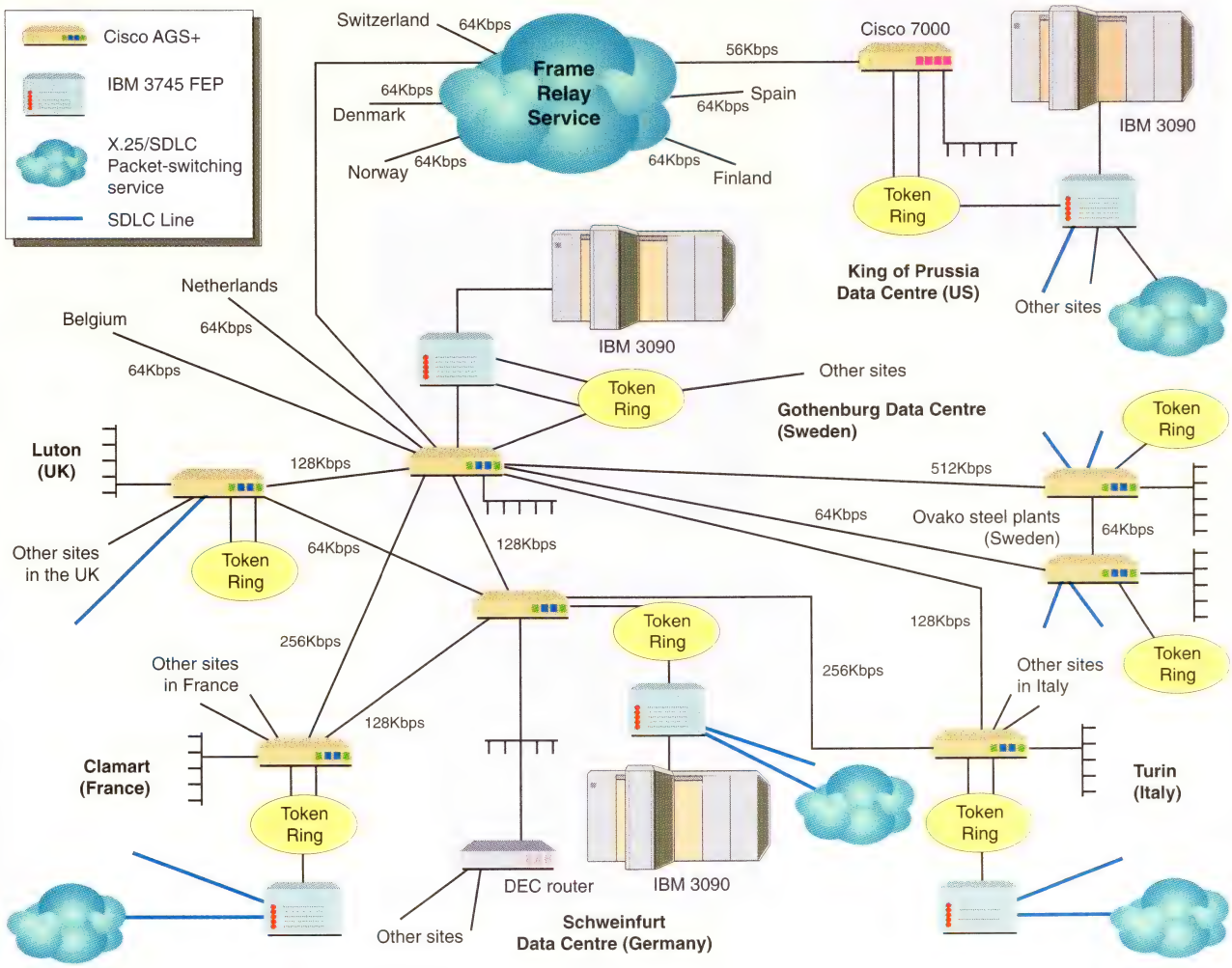
Betting on Bridges

Bergman and Johansson's initial assessments eliminated SDLC and channel extension from the running. Token Ring bridges were still a very attractive option, especially after tests of Olicom's gear showed respectable DECnet performance and revealed that the whole issue of broadcast storms had been blown out of proportion. Olicom's bridges also helped keep down equipment costs by incorporating data compression, a must on Europe's costly leased lines. All of the other technologies required standalone compression hardware. Further, bridges could be managed by SKF's NetView system. Routers meant moving to SNMP.

On the downside, bridges have to work in tandem with FEPs to keep sessions alive when lines fail. And SKF was looking to eliminate FEPs wherever possible.

Figure 2: Router Backbone to the Rescue

Shutting down three of its five European data centres saves SKF about $US4 million a year. The new router backbone delivers far higher bandwidths, and FEPs at some sites have been eliminated. Routers at sites where mainframes have been removed are connected to both Gothenburg and Schweinfurt so traffic can be diverted if a circuit goes down.



After weighing all these issues, Bergman and Johansson decided that a compromise was in order: deploy Token Ring bridges first and then migrate to routers when they matured. But the 'bridges-now, routers-later' scheme was quickly knocked for a loop by IBM's launch of its 6611 router . In Bergman and Johansson's view, Big Blue's announcement was tantamount to its seal of approval for routing SNA. At about the same time, Cisco pointed out that its routers could be configured as Token Ring bridges if the two network planners were dead set on their go-slow strategy. And that it: Bergman and Johansson decided that SKF was going to carry SNA over a router-based IP backbone.

Choosing a router vendor was the next step. At that time, according to Johansson, Cisco was way out in front of the competition in terms of SNA support. Specifically, Cisco offered conversion from SDLC to LLC (Logical Link Control), the data link layer protocol that establishes the sequencing and error control needed to carry SNA over Token Ring. And this meant that Cisco's routers, on paper at least, should be able to eliminate some FEPs — saving big bucks without sacrificing alternative paths.

Cisco also could bridge Token Ring to Ethernet and offered other features that looked very attractive to SNA users.

And what about going with IBM's router? "We were very close to buying the 6611," comments Johansson, "just because it was from IBM." But the computer giant couldn't deliver its box equipped with high-speed V.35 interfaces before January 1993. And it wouldn't consider cutting its prices.

Cisco's Swedish distributor, Upnet AB, won the order by extending a very deep discount and guaranteeing router downtime would never exceed four hours anywhere in the world. In order to meet this pledge, Upnet has put a spare router at each location.

Frame Relay Financing

Once the equipment was chosen, SKF still had to decide on how much bandwidth to dedicate to each connection. As noted, Bergman cut line costs considerably by going with data compression, and Johansson indicates that Symplex was the only vendor offering data compression equipment for high-speed lines when SKF needed it.

Tests showed that Symplex's Datamizers doubled throughput, which meant SKF could halve the bandwidth it ordered. But this calculation didn't apply to sites that only needed 64Kbps connections, since 32Kbps leased lines don't exist. Rather than order up 64Kbps circuits without data compression when less bandwidth was required, SKF decided to use BT's frame relay service, which was a less expensive alternative.

Frame relay also has a number of other advantages. Since it runs over the service provider's meshed backbone, it's potentially more reliable than are leased lines. It also reduces the number of interfaces needed on the router. All of the SKF sites currently connected by frame relay are supported by a single 128Kbps interface on the main AGS+ at Gothenburg. Five separate 64-Kbps interfaces and one at 56Kbps would have been needed for leased lines. SKF also likes frame relay's ability to handle bursts. Johansson says he's measured file transfer rates of 50Kbps over the transatlantic frame relay link, which has a CIR (committed information rate) of 32Kbps.

When Bergman invited bids for frame relay services, he eliminated operators that couldn't guarantee a round trip delay of less than 0.7 seconds for a 1KB frame. Johansson also reduces delays on leased lines by always using a 2.048Mbps V.35 local connection between the routers and Datamizers, even on 64Kbps links. He indicates that dual Datamizers add a delay of about 50 milliseconds on a typical line.

By limiting network delays in this way, SKF ensures that users don't get bogged down when accessing remote data centres. At the same time, by upgrading the remaining mainframes, SKF has been able to get its applications to run much faster.

Free From FEPs

One of the reasons that SKF went with routers in its redesign is that they held out the promise of eliminating FEPs, which has been accomplished at the Ovako steel works and at Luton, Saint Cyr and Milan. At the two Ovako sites, SDLC access lines are connected directly to the routers, each of which runs Cisco's SDLC conversion software. But SKF reports that the program was apt to cut out for no apparent reason in the beginning and still doesn't run perfectly despite revisions from the vendor.

Elsewhere, SKF employs SNA Conversion Nodes from Sync Research to link SDLC lines to the LANs. Johansson says he's using Sync's equipment because it can be overseen by local support staff, who are responsible for connecting SDLC access lines to Sync's converters. And they can do this without meddling with the Cisco router, which is Johansson's responsibility. The snags with Cisco's SDLC conversion software gave Johansson an extra incentive to use Sync's converters, which have performed well since installation in August 1993.

Getting rid of the FEP was easier at Luton, thanks to a managed network service offered by France Telecom Network Services in London. The scheme allows SDLC or X.25 connections at remote sites but delivers all traffic directly to the router at Luton in X.25 format. Since Cisco's X.25-to-LLC conversion software is still in beta test, the X.25 traffic must be shipped over SKF's backbone to Gothenburg. From there it's shunted via a local V.35 connection to the Gothenburg FEP. Johansson says this was the least expensive way to handle the relatively low volume of X.25 traffic from the UK. SKF wants to eliminate its FEPs in Clamart and Turin, possibly using Sync's X.25-to-LLC converters, but Johansson hasn't decided on the best strategy. It's unlikely that SKF will be able to swap out the FEPs at Gothenburg and Schweinfurt, Johansson adds, because of the volumes of X.25 traffic they handle.

A Buzz in the Office

Before SKF placed its order with Cisco, Johansson ran a series of tests on two AGS+ routers in his office. The evaluation created quite a buzz, literally — the fans could be heard all over the building. Engineers dropped by to see what the noise was all about and were quick to ask Johansson if the Cisco routers could really replace IBM's beefy FEPs. And Johansson's confidence wasn't helped by a router at the Ovako plant that rebooted every time it was jolted. Engineers started joking about taking their shoes off before approaching it. In this case, first impressions turned out to be misleading: there have been remarkably few hardware problems since.

Johansson and Wallander built a test network comprising the two AGS+ routers and an IGS router, linked together to form a triangle. A Token Ring and an Ethernet were attached to each AGS+. A FEP was attached to one of the rings and an IBM 3174 gateway and PC attached to the other. DECnet equipment was hung off both Ethernets.

The first test — of alternative routing — was something of a wash. The two network designers couldn't get Cisco's version of OSPF (open shortest path first) to work, and neither could Upnet's engineers. They settled instead for using the vendor's proprietary IGRP (Interior Gateway Routing Protocol). The evaluation of Cisco's SDLC conversion software noted good response times and concluded that 'minor' operating problems could be overcome. In retrospect, Johansson thinks he underestimated those difficulties. SKF used a Sniffer from Network General during these tests and has continued using it since. "It's invaluable for proving where the problem lies," says Johansson.

The evaluations of network management led to an important discovery. Johansson had expected to install monitors at Gothenburg, Schweinfurt, Clamart, Turin, and Luton to give staff at these sites a way to supervise the new backbone. But tests revealed that he could monitor the whole backbone from one screen in his office.

Rock 'n Rollout

With tests completed, SKF plowed ahead with implementation. All of the leased lines had been ordered from Telia AB, the Swedish PTT, under a one-stop-shopping contract. SKF originally specified that the same

Continued on page 113

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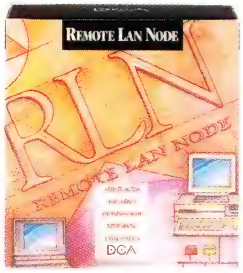

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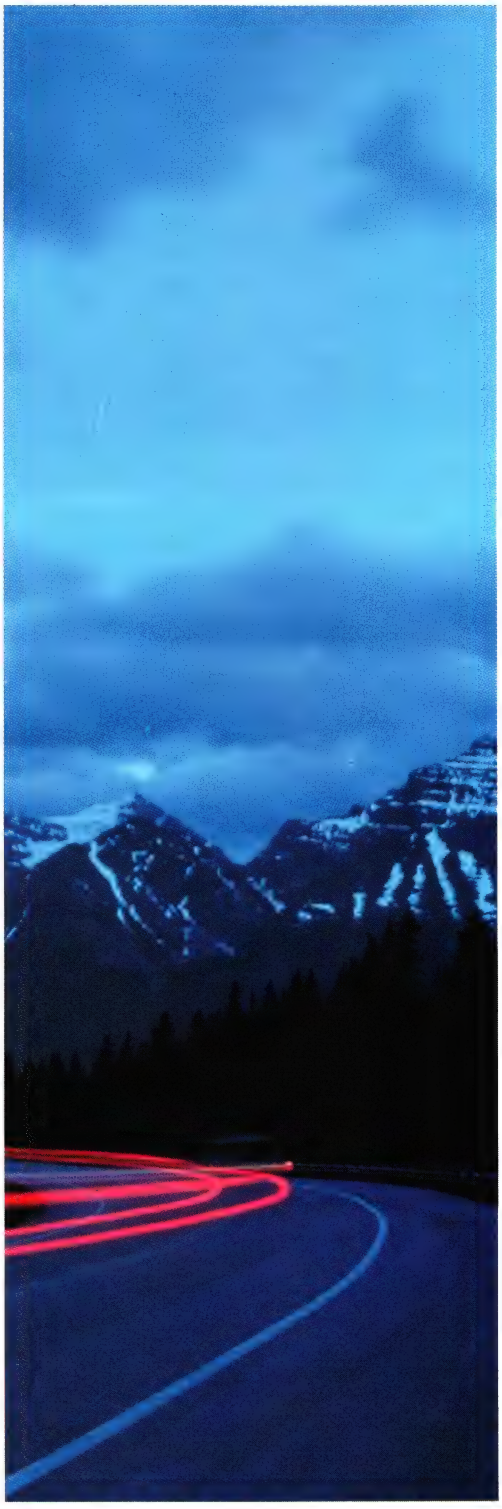

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Making Protocols a Priority

When Toni Bergman and Thomas Johansson set out to evaluate transport technologies for SKF's international backbone, they were hardly big believers in routers. And they were perhaps most sceptical about the technology's much-vaunted ability to prioritise protocols.

Of course, now that Johansson has planned, designed, and installed a global router backbone that carries a mix of mission-critical SNA traffic, DECnet files, and LAN packets, he's seen the light — right? Not exactly. Johansson is still just as sceptical about protocol prioritisation and wouldn't attempt to use it on the backbone. What he has done, however, is exploit a router's inherent ability to direct different protocols to different ports — thus attaining a rudimentary though effective form of prioritisation.

Johansson began his design effort by simplifying issues radically and keeping all LAN traffic off SKF's backbone. This left him with only two protocols to deal with: SNA and DECnet. And since each major site on the SKF network is linked to a data centre by two lines, he can assign one protocol to each.

For example, the Cisco router at the Clamart installation in France is configured to send all SNA traffic on the direct route to Gothenburg and all DECnet traffic on an indirect route via Schweinfurt to Gothenburg. This is achieved by assigning DECnet 'costs' to each line and making sure that the cost of the direct line is always higher than the aggregate cost of the two circuits on the indirect route. Thus, the router shunts all DECnet traffic onto the cheaper path. In the event of a line failure, all traffic uses the remaining circuits.

Key to this segregation strategy is the use of a filtering bridge to keep LAN traffic off the backbone until Johansson was ready for it (see the figure). An IBM 8228 MAU (multiple access unit) links the FEP to the Cisco router. It's also connected to the bridge — a PC running IBM's Token Ring Network Bridge program — attached to the company's Token Rings.

By adjusting the bridge's filters, Johansson can allow selected applications access to the backbone. Everything other than traffic from the FEP passes through this filter, including data from such SNA devices as IBM 3174 gateways, AS/400s, and SDLC converters on the Token Rings. SKF has a standby MAU at each site. DECnet traffic arrives via an Ethernet LAN attached to a separate interface on the router.

Johansson's approach forces him to prioritise by protocol rather than by application, as he would like. He indicates that some of SKF's SNA applications are of crucial importance because they support production and other aspects of its worldwide business. At the same time, it wouldn't hurt to delay SNA applications like printing to make sure that R&D engineers get reasonable performance from DECnet database access or TCP/IP file transfers. In an ideal world, in fact, Johansson would like to prioritise traffic as follows: SNA interactive, Telnet, SNA program-to-program, SNA print.

Unfortunately, Cisco routers don't support all SNA's prioritisation mechanisms at present, which prevents Johansson from optimising performance. IBM makes it possible to assign high, medium, or low priorities to traffic using two different techniques. When SNA traffic travels between FEPs, the FID-4 format frames indicate priority. Cisco's routers can read these bits and handle the frames accordingly. With all other SNA traffic, the priority of each session is set at startup, as defined by APPN, and the network equipment takes prioritisation into account. Since Cisco doesn't yet support APPN, its routers can't cope with this type of scheme.

Cisco has similar problems with some of SNA's flow control mechanisms ('pacing' in IBM parlance). According to Toni Bergman, SKF is starting to notice long response times and occasional session failures as a result of this shortcoming.

Pacing enables net managers to prevent file transfers and print jobs from hogging so much bandwidth that interactive traffic can't get through. IBM specifies two types of pacing: fixed and adaptive. With the former, the user sets a constant window size. If six were to be chosen, for example, the sending station would wait for an acknowledgment after every six frames. With adaptive packing, the sending and receiving stations negotiate window size, increasing it under a light load and decreasing it under heavy loads.

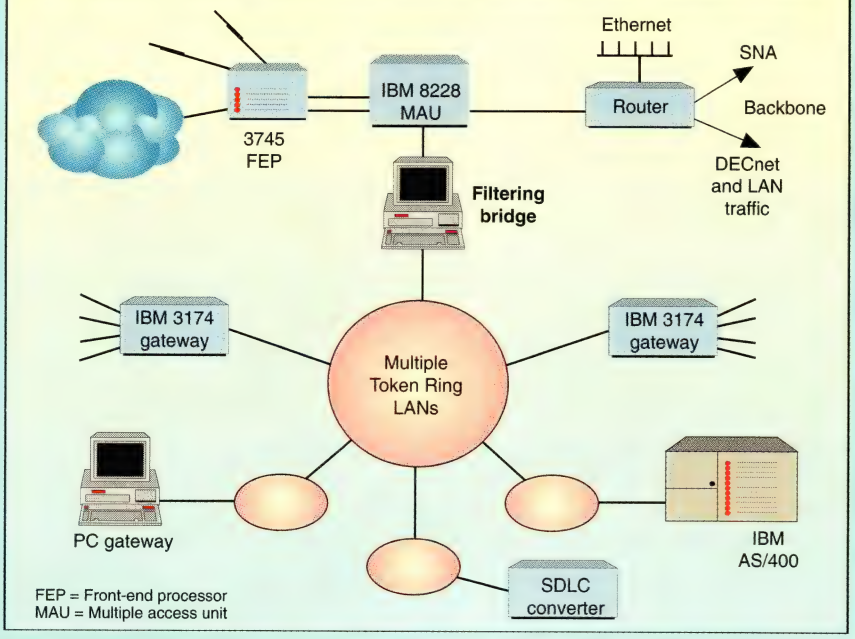
Unfortunately, adaptive pacing and Cisco routers don't mix. Once again, APPN is the key. "The problem is that routers don't recognise individual sessions, so they can't slow down traffic by trying to decrease windows," says Johansson. As a result, sending stations end up using all the available WAN bandwidth. According to Johansson, transmitting 40KB of data as 20 consecutive 2KB frames delays any other traffic on a 64Kbps line by more than five seconds.

In order to sidestep this problem SKF uses small frames for print traffic and file transfers and sets fixed pacing windows very low. What it comes down to is that file transfers are faster on the new backbone (thanks to higher-bandwidth lines) but not as speedy as they could be.

A bigger potential problem is that AS/400s only support adaptive pacing, so SKF can't prevent file transfers and print traffic from the midrange systems on the backbone from using up all the bandwidth. "We can only use small frames and hope for the best," says Johansson.

Peter Heywood

Separate by Strategy



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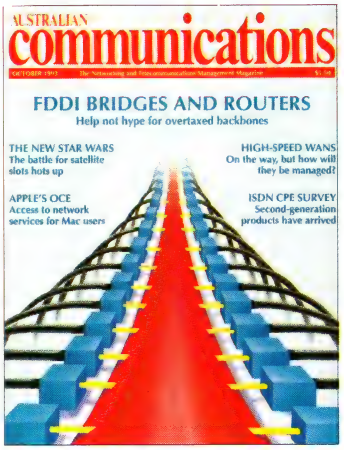

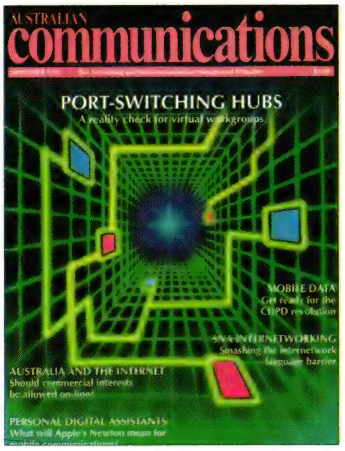

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Side-by-Side Strategies

	MULTIPROTOCOL ROUTERS	SDLC	CHANNEL EXTENSION	TOKEN RING BRIDGES
Keep sessions alive if line fails	Yes	No	Yes	Yes, with FEPs
Traffic put back on original path after outage	Yes	No	Yes	No
Multiple protocols	Yes; limited prioritisation	No	Yes; no prioritisation	Yes; no prioritisation
Load balancing	Limited	Limited	Limited	No
Compression on WAN links	Needs separate equipment	Needs separate equipment	Needs separate equipment	Integrated in bridges
FEP-related costs	Low; FEP elimination possible	High	Low	Low
Other advantages	Unlimited network size	Proven technology; low overhead	Proven technology	PC-based; managed by NetView
Other disadvantages	New technology; SNMP needed	Mainframe-dependent	High cost	Limited network size

From page 108

V.35 interfaces be used in all locations to allow it to move equipment freely from site to site. But getting the V.35 interfaces proved to be a problem and ultimately they were provided only in Sweden and Italy — after a struggle. Deutsche Telekom tried to get around the trouble by furnishing conversion cables. They turned out to be the wrong type, causing the router to lock up. After that experience, SKF accepted whatever interfaces the PTTs could supply and reconfigured its equipment to match. There also was trouble getting the leased lines on schedule in all countries except Sweden.

Johansson and Wallander configured and tested the routers in Gothenburg before shipping them to various sites. He also supervised their installation, one site at a time, starting with the data centres that were being retained at Gothenburg and Schweinfurt. At centres scheduled to be closed, the mainframes and old FEPs were removed once applications had been replicated on one of the two remaining hosts, a process that took about two months. The Turin mainframe was removed in March 1993; the Luton mainframe, August 1993. The Clamart host was eliminated in December 1993.

For the most part, the rollout went smoothly — with a few notable exceptions. One Friday afternoon at about 5 o'clock Johansson was getting ready to meet his girlfriend at the theatre when the phone rang and an operator in Schweinfurt told him the Italian network was down because he couldn't load the IBM NCP (Network Control Program) over the backbone to the 3745 FEP in Turin. Plans for the evening abandoned, Johansson grabbed the next flight to Schweinfurt, and by early Saturday he'd found non-standard frames in Sniffer traces of the Token Ring traffic. An IBM support engineer from Stuttgart was called in, who identified the traffic as SIM (Set Initialisation Mode) frames, used by IBM to load operating software into remote equipment.

The problem was traced to Cisco's LLC spoofing software, which didn't recognise the SIM frames and was failing to route them to the FEP. Johansson believes that IBM is to be blamed for this problem, since it didn't mention SIM frames in its LLC spec. Even IBM's own 6611 router couldn't handle SIM frames at the time, he adds. Luckily, spoofing isn't mandatory on connections between FEPs; all Johansson had to do was turn the software off. Still, the difficulty illustrates just how tricky it is to route SNA traffic. (SIM support has now been added in an upgrade of Cisco's software, but SKF isn't using it.)

Closing the Window

Other troubles proved tougher to diagnose. Two weeks before the scheduled removal of the Italian mainframe, Johansson was testing the connections between Turin and Schweinfurt by pumping production traffic back and forth over the direct route (thus doubling the load likely in real life). Everything was going fine; users in Italy were reporting response times of only 0.3 seconds.

Then Johansson decided to try one more test, simulating a line failure so that traffic was routed via Gothenburg to Schweinfurt. Within minutes, Italian users were on the phone yelling that response times had suddenly gone to 10 seconds. It looked as though the router was to blame but Johansson couldn't find the fault.

After more than a week's fruitless investigation, Johansson and Bergman called in Arne Olsson, IBM's best systems engineer in Sweden. Hours of phone calls later, Olsson identified the problem in the IBM FEP software. A default window was set to require the FEP to wait for an acknowledgement after sending eight frames, and the extra delay in sending acknowledgments via Gothenburg was interrupting the flow. Once the window size was increased, the problem disappeared.

Bergman and Johansson play down these sorts of problems, pointing to long periods of reliable operation. Users in Clamart, for instance, had access to applications running in Gothenburg for 99.94% of the time during the first quarter of this year. What's more, response times are equal to or better than those possible on the SNA backbone, and file transfers are faster thanks to higher bandwidths. And all of this has been achieved while keeping within budget.

Johansson also praises Cisco's gear for its ease of configuration and functionality. At Gothenburg, the configuration file for the router amounts to a mere 200 lines of code, compared with 5,000 lines for the FEP. Cisco's ability to carry X.25 over IP, its Token Ring-to-Ethernet bridging, and its methods of dealing with DECnet addressing problems also score high.

Nevertheless, there's always room for improvement, and Johansson has a big list of things Cisco could do better. For starters, he isn't happy with tech support, commenting that he might just as well phone a recorded message that says, "Reboot your router and if that doesn't work upgrade your software." But as Johansson found out, upgrading software can be very risky. When the LLC spoofing software on the Luton router started to misbehave, Cisco supplied a fix that ran without a hitch for five days. The revised software was then loaded on the other routers. Within two days, all of them had crashed. Luckily, Cisco had another revision in the pipeline, which was rushed into service and cured the problem.

Peter Heywood is International Managing Editor for Data Communications International, based in London.

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BGLmedia

Integrated Branch Solution

Olicom has released what the company says is the first product to integrate the flexibility of a Controlled Access Unit (CAU) and the WAN capabilities of a remote bridge.

The Olicom Remote Bridge is a 19-inch rack mountable unit integrating intelligent hub features with source-routing remote bridging. It connects up to 40 workstations via two STP or UTP Lobe Attachment Modules (LAMs), which in turn can connect up to 20 lobes.

Features of the new product which make it especially suited to branch sites include data compression capabilities and speed-optimised hardware and software supporting line speeds of 9.6Kbps to 2.048Mbps; and the inclusion of Olicom's PowerMACH drivers, which optimise the Media Access Control code, resulting in additional speed and efficiency, officials said.

The Remote Bridge offers several network management options, such as IBM LAN Network Manager/NetView, SNMP, and Olicom's own network management products.

The company has also announced a new Token Ring Remote Multiport Bridge. With features similar to the Olicom Remote Bridge, the Multiport Bridge is designed for central site implementation where it acts as a concentrator bridge for up to four Remote Bridges.

When equipment is used to dynamically adjust the bandwidth on a WAN link, the Multiport Bridge can automatically adjust to the WAN speed.

Force Technology
(02) 971 1000

The Apple Newton 110 features improved software and design

Newton Upgrade

The second generation of the Apple Newton MessagePad has been released in Australia.

The Model 110 has improved handwriting recognition, including letter-by-letter recognition, and the unit's RAM has been increased from 640KB to 1MB. New AA batteries replace the original AAA batteries, providing longer battery life, while a fast recharge feature now allows NiCad batteries to be fully recharged in 2-3 hours.

Improved design elements include a flip-top protective lid, a round telescopic pen, and a narrower form factor. Screen contrast can be adjusted via an external control, and the PCMCIA slot has been moved to the side of the unit. All software updates since the launch of the original model have also been incorporated into ROM.

The new Newton MessagePad 110 is available for $1,195.

Apple Computer
(02) 452 8000

Madge PCMCIA Card

Madge has unveiled its Smart 16/4 PCMCIA Ringnode, a new credit-card sized Token Ring adaptor offering high-performance portable PC connectivity.

The card performs up to four times faster than external parallel port adaptors, and up to twice as fast as other PCMCIA adaptors in multi-protocol environments, company officials said.

It comes with Smart LAN Support software which contains Fastmac drivers and Smart Software.

The main features on the board include: 512K on-board adaptor RAM with generous buffer space and support for up to four protocols; LAN Support Software that downloads protocols onto the adaptor card to be executed on the processor; simplified configuration set-up; and support for UTP and STP.

The 16/4 PCMCIA Ringnode is covered by a full five-year guarantee, and Madge provides a free technical hotline support service designed to assist purchasers.

DDP (02) 906 1200

The Cellular Card modem is only slightly larger than a credit card

Australian-Made PCMCIA Modem

Queensland-based Charter Pacific Communications has introduced a new PCMCIA-based modem called the Cellular Card, which can connect to both cellular networks and the PSTN.

The card, developed in conjunction with US modem giant Rockwell, supports fax and data transmission speeds of up to 14,400bps, and comes with QuickLink Windows-based data/fax software, OCR (optical character recognition) software, and Z Modem. It includes V.42LAPM and MNP2-4 error correction and V.42*bis* and MNP5 data compression protocols, as well as the MNP10 data throughput enhancement and error correction protocol, boosting average throughput to 57.6Kbps while maintaining data integrity.

It supports most cellular phones with hands-free facilities including NEC, Ericsson, Fujitsu, Oki and Nokia, and software drivers to support other makes are currently under development, officials said. It works with most popular models of notebook which have a Type II PCMCIA slot, and is the first product to be totally compatible with Apple's Newton Personal Digital Assistant. The Cellular Card can auto-dial and auto-answer, operates in both synchronous and asynchronous modes, and comes with diagnostic routines to isolate any problems quickly.

It comes with a three-year warranty, and is priced at $995.

Charter Pacific (075) 741 969

GSM Protocol Analyser

Danish manufacturer GN Elmi has released version 2.20 of its Telecom Protocol Analyser ETP 71, which is now able to undertake all analysis, fault detection and installation testing for GSM networks. The unit incorporates a new 2Mbps line interface and handles all subrates used by GSM operators on the A-bis interface (8Kbps and 56Kbps).

Madge's new adaptor is up to four times faster than other adaptors

The Marathon mixes data, fax and voice over ISDN or DDS lines

New Micom Marathon Network Server

Datacraft has launched the new top-of-the-range network server offering from Micom, the Marathon 20K, which integrates data, voice, fax and local area network traffic, and also reduces the cost of multi-site networking by consolidating LAN traffic with voice, fax and data over ISDN and DDS lines. Supporting multiple links to remote sites, it also switches voice in digital form to provide optimum quality, and features advanced speech compression technology for high quality voice connections which consume as little as 4Kbps to 16Kbps of bandwidth.

The product is based around the latest Microband ATM fixed-size cell relay-based protocol technology, which is ideally suited to voice, data, LAN and multimedia traffic. The Marathon 20K comes with a redundant power supply called the Power Plus, which can share the power load or take over complete network functions should the main supply fail.

Supporting up to 50 remote sites, the Marathon can handle almost any LAN protocol, officials said, including DEC VT100, HP ENQ/ACK and IBM SNA SDLC. The voice/fax switching feature enables voice and fax users to connect to any other compatible channel in a Marathon network. The Remote Terminal Server option provides a LAN gateway for asynchronous users at remote sites, and for LAN/WAN connectivity the 802.3 Ethernet Multiport Remote LAN Bridge option provides LAN-to-LAN connectivity.

Datacraft (03) 727 9111

Existing users of the ETP 71 can upgrade their instruments for a special reduced price until the end of this month.

The company has also recently released the EGM 35, which is a hand-held battery-powered test unit dedicated to the measurement of GSM A-bis signalling.

GN Elmi (03) 890 6677

Stackable Switch

Retix has announced what it says is the first stackable Ethernet switch, the new SwitchStak 5000. The product can be scaled from eight to 64 ports, offering users a flexible, 'pay as you go' solution, officials said.

Each port provides up to 10Mbps throughput, and can be connected to a single workstation or server, or to a subnetwork of up to 3,000 devices. The switch differs from other products in that SwitchStak modules can be interconnected with an external high-speed StakBus, which provides connections of up to 175Mbps between switches and allows up to eight SwitchStak units to be interconnected locally over twisted pair cable, or remotely for up to two kilometres using fibre.

Officials said the unit offers many of the features found in high-end switches, including virtual networking capabilities, a high-speed backplane, and an optional redundant power supply. The company also plans to add a two-port fast Ethernet server module later this year, and a one-port dual-attached FDDI backbone interface module early next year. The expansion port will also accommodate additional interface modules and support new technologies such as ATM, said officials.

Within a workgroup, the SwitchStak 5000 can be used to segment existing LANs to provide support for high-bandwidth applications. It uses intelligent switching design and Intel i960 RISC processors, filters frames not destined for another segment, and discards runts, jabbers and corrupted packets.

It also implements the 802.1d Spanning Tree algorithm, and can be managed using SNMP, supporting both MIB I and II.

Retix (02) 369 1333

ATM Test System

Testcom-Data has released the new DeskNet ATS-5300 fully integrated VXI test platform for the test of asynchronous transfer mode (ATM) systems.

The system supports up to 10 ATM modules and has a variety of possible physical interfaces such as DS3, OC3, E3 and so on. It is sold with TESTview analysis software which allows for independent control, independent results logging, and independent user programmability of each media interface.

The ATS-5300 has physical layer testing capability for error/alarm monitoring and generation, BER testing, and control and display of overhead bytes to perform rapid characterisation of the layer under test.

Additionally, the set features variable rate cell generation up to bandwidth, a range of programmable cell generation and monitoring options, performance testing and quality of service testing.

Testcom-Data (02) 630 7528

Token Ring PCI

Danish vendor Olicom has released the industry's first Token Ring PCI adaptor.

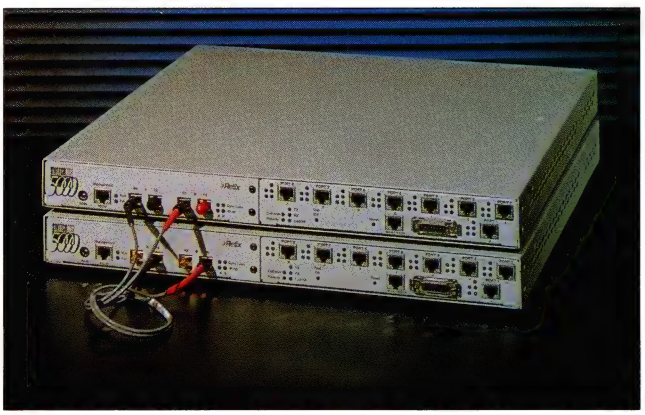
With a 32-bit PCI bus master interface, the adaptor features high frame rates and low latency, with data transfer speeds of up to 133Mbps.

It operates at both 4Mbps and 16Mbps, and features autosensing of STP or UTP connections, and an optional Flash remote program load. It also includes a set of desktop management capabilities based on SNMP and DMI (Desktop Management Interface) standards.

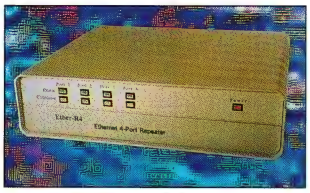
The company has also added to its line of PCMCIA cards with the release of an Ethernet card, called the EtherCom PCMCIA. The card features Olicom's high performance drivers and limited memory consumption, and comes with a simple installation package.

The EtherCom PCMCIA card interfaces with all standard notebook, laptop, palmtop and desktop computers, and is available in a UTP-only version or a version supporting both UTP and coax. It supports NetWare, LAN Manager and IBM LANs and runs under DOS, Windows, Windows NT, IBM OS/2 and a range of Unix versions.

Force Technology
(02) 971 1000



The SwitchStak is the market's first truly stackable Ethernet switch



Speedycom's Thin Ethernet repeaters are compact and tough

Thin Ethernet Repeaters

Speedycom has released two new models of Thin Ethernet Repeater which allow the connection of segments of Ethernet cable and the extension of the network trunk line.

The 2-port model allows users to join either two segments of thick or thin cable, or one segment of thin cable to a segment of thick cable. The 4-port model can join up to four segments of thick cable, thin cable, or a mix of both. The repeaters can also be used to increase the number of PCs that may be connected to a LAN, officials said.

The repeaters are compact, light and sturdy, and come with LED indicators to monitor traffic on each connected segment as well as data collision on the segment. Partitioning is provided for each port, so problems which occur on one segment are automatically isolated.

Speedycom (09) 388 1755

GatorAccess MP

ADE Network Technology has launched Cayman Systems' new GatorAccess MP multiprotocol remote access server for Ethernet networks, which officials said allows remote users to transparently access the corporate network from any location around the world.

Using GatorAccess MP, any authorised PC or workstation can dial up using a standard modem and access network services such as e-mail, printing and file sharing as if they were a locally-attached node, officials said. Expandable from 10 to 30 dynamically configured serial ports, GatorAccess MP supports point-to-point protocol, TCP/IP and IPX, as well as Serial Line IP (SLIP) and Compressed Serial Line IP (CSLIP).

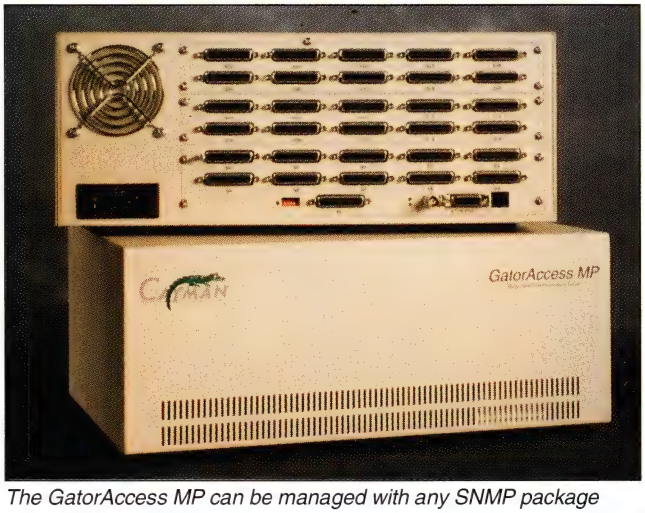
It supports speeds of up to 115.2Kbps over industry-standard V.32*bis*, V.42*bis* and V.fast modems, and offers security features like multi-level password protection, automatic dial-back, inbound and outbound packet filtering and PPP CHAP and PAP authentication.

GatorAccess MP provides a single dial-in number for both PC and workstation users, eliminating the need for complex dial-in procedures, pre-configured ports or dedicated modems. The system can also sense if the connection is IPX or TCP/IP, automatically configuring the ports and bandwidth.

The unit can be managed with any SNMP-compliant management package such as HP OpenView or SunNet Manager.

GatorAccess MP sells for $5,949 for 10 serial ports and $9,777 for 30 serial ports.

ADE Network Technology (03) 543 2677



The GatorAccess MP can be managed with any SNMP package

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Call Manager

LAN Systems has announced its LAN2LAN/MPR and LAN2PC products from Newport Systems will now support Newport's Call Connection Manager.

Call Connection Manager is designed for applications which need occasional dial-up access to a remote LAN, such as network backup or e-mail. It supports LAN2LAN/MPR in a dedicated standalone PC or in a NetWare environment, and makes use of dial backup, bandwidth on demand, activity calling and call scheduling to establish and disconnect calls. It can utilise V.25*bis* to control calls for ISDN Terminal Adaptors, DSU/CSUs and traditional modems.

The product has a number of features including:

- A dial backup feature which can backup a dedicated line after a specified period of line outage;
- The ability to create a rotary group, via the bandwidth on demand feature, which adds additional data lines as traffic increases and disconnects established connection when traffic is reduced;
- Call scheduling, which allows connections to be scheduled for day of week and time of day. Incoming calls can also be controlled via a schedule and by verification of the calling number when this facility is available from a carrier.

Call Connection Manager's management features include a status screen and scrolling event log, allowing users to monitor either a specific connection or all connections. Remote connections and calling schedules can also be assigned names to improve user friendliness.

Call Connection Manager support for LAN2LAN/MPR for NetWare, LAN2LAN/MPR standalone and LAN2PC is available immediately. The base configuration with two WAN ports is priced from $3,500.

LAN Systems (02) 901 3655

Automatic Fax Routing

Brisbane-based Network Image has announced NeuralinFax, an integrated solution combining fax server automatic routing and character recognition.

Developed by Mitek Systems, the product uses neural network technology to read incoming faxes and route both hand- and machine-printed faxes directly to the workstation where the recipient is logged on.

The system can be integrated into any network running Windows, DOS, OS/2, Unix or Macintosh software having either a fax server or a fax with an RS232 interface. On receipt of a fax, the name is compared to a database of all network users, including name, nickname, department, title, position and even common misspellings. When matching is complete the fax is routed to the appropriate network user.

Network Image
(07) 393 1933

First IP Router for NT

Eicon Technology has announced the new IP Router for Windows NT, which the company claims is the first LAN interconnection solution which routes TCP/IP over a wide area network within a Windows NT environment. The software provides office-to-office connectivity over ISDN, frame relay, X.25, or via a leased or dial-up line using Point-to-Point Protocol (PPP).

Officials said the router is an effective branch office solution which integrates easily into existing networks and can reduce transmission costs using high performance compression, resulting in significant savings.

Subsequent releases will feature an SNMP-based Windows 3.1 network management console and support for Microsoft's 'Daytona' and Digital's Alpha.

Available immediately, the Eicon IP Router for Windows sells for $1,905.

Eicon has also announced its WAN Services for Windows NT product now offers X.25 support for Microsoft Exchange Server, a product designed to enhance workgroup collaboration across functional, organisational and geographical boundaries.

Eicon Technology
(02) 959 1960

Dial-Only V.fast Modem

General DataComm has released a new dial-only V.fast modem and announced price cuts across its existing modem range.

The new V.F. 28.8 retains all the features of the company's existing V.fast modem, but in a dial-only format. It offers 28.8-Kbps synchronous transmission rate across the PSTN, and using built-in compression can achieve effective throughput of up to 128Kbps in an asynchronous environment, officials said.

The modem is particularly well-suited to situations where line quality is inconsistent, because it has the ability to fall back to lower speeds when the line is poor, and fall forward during the same call if the quality of that line improves. It is priced at $1,577, excluding tax.

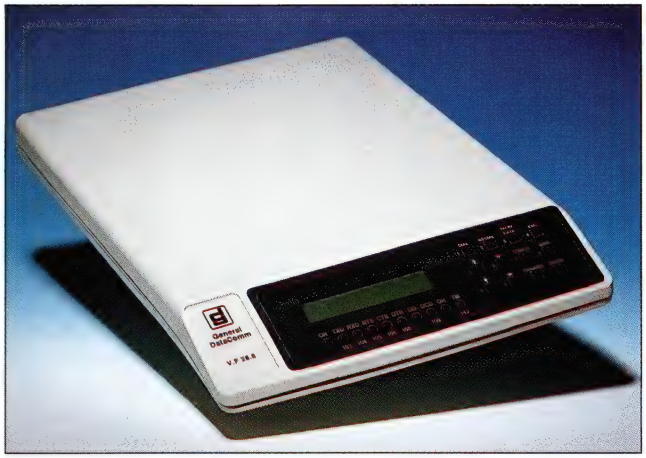
GDC is also offering a free software upgrade, downloadable over the PSTN, to the V.34 standard when it's available.

General DataComm
(02) 959 5099

NetDirector for OS/2

UB Networks (formerly Ungermann-Bass) has announced the release of version 17.1 of its client/server PC management platform, NetDirector for OS/2.

Enhancements included in the new version include support for OS/2 2.1 and two new applications — FocusView, an advanced graphical hub management application, and Secure Domains, which offers domain-based management as well as advanced security features.



The new V.F. 28.8 dial-only modem adapts to optimise line quality

Officials said the new features make the product easier to use, and give it unrivalled capabilities for team-based management of distributed networks.

The FocusView application simplifies management of complex devices on the network by concentrating on pertinent information and presenting it an a graphical, simple manner.

Secure Domains allows users to create administrative domains to which managed devices can be assigned. Domains are flexible and are defined on the basis of organisational needs.

Device domains may include all devices of a specific class — such as routers — or all network resources in an organisational unit or geographic region. Security profiles can then be created to define a wide range of individual requirements for each domain.

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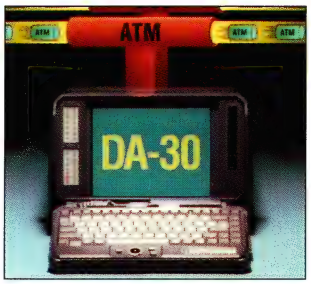

The popular W&G DA-30 analyser now has ATM capabilities

NetDirector 17.1 with FocusView is available immediately for OS/2 1.3 and LAN Manager, and for OS/2 2.1 and LAN Server, and is priced from $7,714 to $35,134. Secure Domains is also available now, and is priced from $1,706 to $7,286.

UB Networks (03) 693 8200

DA-30 ATM Module

Wandel & Goltermann has recently released a new module which brings DS3 ATM analysis capabilities to the DA-30 Internetwork Analyser. The new DS3 Cell-Based Interface Module and the 52Mbps Broadband WAN Feature Module fit into two DA-30 slots, permitting dual analysis such as Ethernet-to-ATM or FDDI-to-ATM.

The DA-30 allows for simultaneous data receive and transmit at 45Mbps, and each interface module has a DS3 transmitter for emulation of Cell Drop & Insert, and two DS3 receivers for full-duplex analysis of protocols. Real-time analysis and offline examination are provided, allowing for full analysis of the PLCP, Cell, AAL and Frame layers including error/status monitoring, flexible transmit, full line-rate filter/trigger/capture and decoding. The unit allows for extensive error insertion capabilities and foreground and background queues for creating realistic network traffic conditions, and captured traffic is held in a 16MB buffer on the Broadband WAN Feature Module for detailed off-line analysis.

Wandel & Goltermann (03) 690 6700

Token Ring For ONcore

Chipcom has announced a series of integrated Token Ring products for its ONcore Switching System hub.

The initial release comprises five products — three media modules and two daughtercards — which the company says will significantly increase the reliability, simplicity and robustness of Token Ring networks, and provide a comprehensive set of Token Ring switching options.

The ONcore Token Ring Port-Switching Media Module; Token Ring Dual Fibre Repeater Module; Token Ring Passive Media Module; Token Ring Network Monitor Card; and Token Ring Jitter Attenuator Card are all based on Chipcom's PowerRing technology, which incorporates advanced features such as active re-timing, automatic beacon recovery, wrong speed protection, dual ring recovery, jitter elimination and intelligent power management.

The single slot 18-port Port Switching Media Module allows individual devices to be switched among multiple Token Ring networks over either STP or UTP wiring. A single port can be switched to any of 10 ONcore System backplane networks and to up to 11 individual rings per module.

The unit uses dual phase-locked loop circuitry to strengthens and re-times signals on each port, and supports 4- and 16Mbps Token Ring networks simultaneously.

The Dual Fibre Repeater Module has 10 active re-timed ports and supports two sets of fully repeated fibre ring in/ring out trunks for connecting to other ONcore hubs or compatible equipment.

The Passive Media Module is a high density media solution which can suit both STP and UTP environments, providing 20 ports per module supporting up to 320 users per hub. It also features on-board beacon recovery and an onboard repeater

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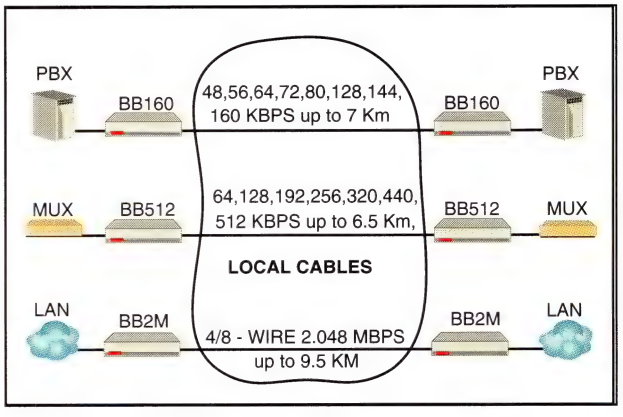

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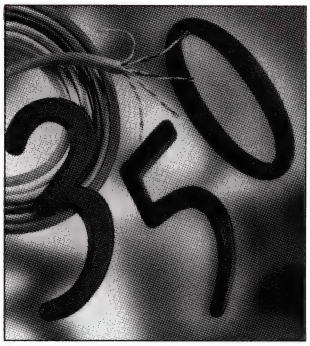

The DataTwist 350 offers stable performance up to 350MHz

to minimise jitter, and can support module switching of its 20 ports to any of 10 backplane Token Ring networks or one module ring.
Chipcom (02) 451 2299

High Performance UTP

Belden Electronics recently introduced the new DataTwist 350 unshielded twisted pair network cabling which is able to maintain stable electrical performance to frequencies of up to 350MHz — more than triple the current verified frequency of the Category 5 cable specification, according to officials.

The company says the new cable also surpasses other data grade UTP cables in areas such as capacitance unbalance, resistance unbalance, impedance, structural return loss and attenuation. For example, compared to EIA-TIA 568 TSB 36 Category 5, impedance and structural return loss are improved by as much as 50%, while capacitance unbalance is improved by up to 400%.

This enhanced performance is due to a new manufacturing process which maintains the cable's dimensional stability, allowing for smoother and improved electrical characteristics, officials said. The design of the DataTwist 350 also allows for users to validate their installation to Category 5 connectorisation requirements after the cable has been installed.
Belden Electronics
(03) 826 0448

Radio Base Station

Trio Communications 2000 has released a fully Australian-designed and manufactured radio base station designed specifically for point-to-point and multipoint data networking,

The hot standby fully redundant TC-900DBHS features high reliability, and works with Trio's 9,600 Data Radio Modem to form a data radio modem installation.

The radio unit's 'hot-swap' technology can constantly monitor both the RF characteristics and the data integrity, and microstrip hybrid combining networks are used to provide maximum reliability of RF changeover circuits to ensure 'soft fail' operation.

The full duplex 5-watt unit features automatic changeover of duplicated devices, bar LED status display showing diagnostic indicators in a graphical format and over-voltage and surge protection. It also offers stream routing for multi-port operation, transparent remote diagnostics,

Trio's TC-900DBHS radio base station features 'hot-swap' capabilities

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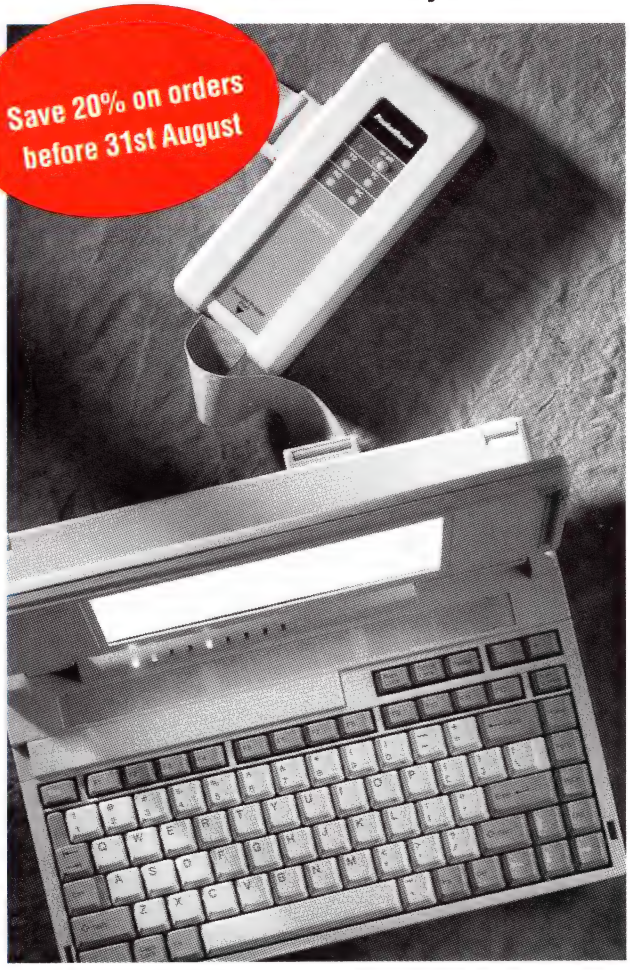

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synchronous interface with DDN clocking capability, selectable 1.2-19.2Kbps asynchronous RS-232 host interface, collision avoidance facilities and internal repeater operation, making it suitable for a wide range of SCADA and distributed data applications, officials said.

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Multimedia Disk Drive

Micropolis Corporation has announced the availability of a new disk drive, the Scorpio 1991 AV, which is designed for multimedia applications.

The 5.25-inch disk features 9.1GB of formatted capacity at a low cost, officials said. It has a fast internal data rate, a predetermined audio/video data rate of 4.3Mbps, and a maximum sustained transfer rate of 6.4Mbps.

Officials said the 1991 AV has been optimised for continuous, sustained delivery of data in long, sequential blocks. It offers advanced cache management for improved write performance, coalescing multiple write commands into a single disk revolution, while multi-segmented read-ahead caching improves read performance by allowing most accesses to be services from the cache buffer. Officials said these features dramatically improve non-interlaced audio/video track systems by eliminating extra seeks between audio and video data.

The new Scorpio 1991 AV features a 500,000-hour Mean-Time-Between-Failure, comes with a five-year warranty, and is priced at $7,990.

Micropolis (02) 959 2326

Full Duplex Ethernet

Cabletron has launched the first family of Full Duplex Ethernet Network Interface cards for ISA bus systems.

The new E2200 cards support a wide variety of media types and network operating systems including Novell, Microsoft and IBM. Available in three models to suit any AT PC, the cards can run in Full Duplex 20Mbps mode or 10Mbps standard mode.

Cabletron Systems
(02) 950 5900

Editor's Note

The Gandalf LANline 5250 multiprotocol router, which was reported as being available from Gandalf Pacific in August's *Product File*, is now distributed in Australia by both CTEC (02) 975 4722 and Infotron Systems (02) 417 7366.

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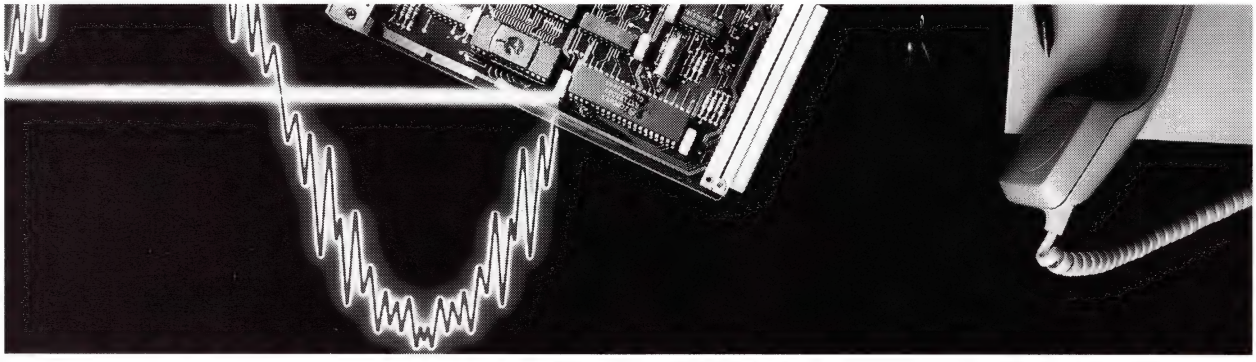

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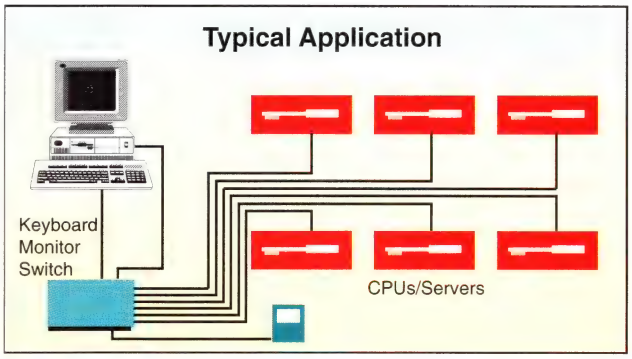

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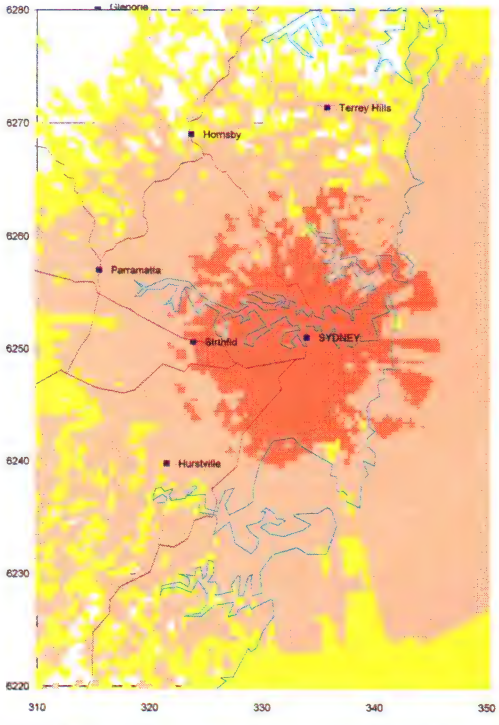

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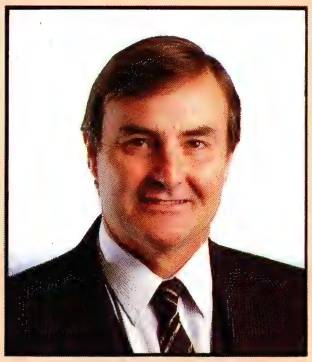

Editorial by Wally Rothwell

A Creative Structure for the Clever Country

Interactive communications services are necessary to build the clever country. Being satisfied with one-way or distributive services is a recipe for the stupid country.
— Anon. BSEG Workgroup

'Convergence of the communications, computing and broadcasting industries is being driven by three important technology developments — rapid advances in computer processing power, recently-developed digital compression techniques, and the increasingly widespread installation of optical fibres. These developments guarantee that communications systems of the future will be vastly different from today's.'

This extract, from the recently produced interim report of the Broadband Services Expert Group (BSEG) titled 'Networking Australia's Future,' emphasises the fundamental drivers of our thrust into a new and, in some ways unknown, information world.

Convergence of information technologies is something we have been talking about for years, but now it is suddenly upon us and it is demanding much larger bandwidth and transmission rates than before.

These developments have given rise to the emotive terms 'information superhighway' and 'Global Information Infrastructure,' which the BSEG shrewdly avoids. Instead it prefers to suggest that 'what we are looking at is more a web or network of connections — some broad, some perhaps very narrow.'

The very interesting and comprehensive report looks at a ten-year time frame in setting out its vision for the future of broadband services.

It makes the point that the convergences that are made possible by broadband technologies are very powerful enabling tools and that the convergent services have the potential to transform our lives — in working, learning, communicating and leisure. Our society will be transformed in ways that we are presently unable to appreciate, as will be our enterprises and public institutions.

Finding Our Own Way

The BSEG is clearly of the opinion that, because we are in many ways a unique society, in terms of national attitude, demography, racial integration and our traditional take-up of new technology, we must find our own Australian vision for broadband services.

Pleasingly too, it seeks to involve the whole community, in attempting to resolve the considerable uncertainties about new applications, demand for services, delivery technologies and making the services universally accessible.

Also clearly expressed is the view that demand for services, rather than the availability of technology, should determine the pace of introducing networks and applications. On this point, while one can readily acknowledge that the so-called 'technology push' frequently leaves a vacuum in particular markets, as with Teletext, CT2 and, to a certain extent ISDN, technology seems to be galloping forward so fast that, if we wait for user demand, we may be left behind anyway. It certainly presents a problem for finely balanced decisions. And, as the interim report acknowledges, there is an axiom in telecommunications that says that, no matter how much capacity is provided, users will find a way to fill it!

Content and Carriage

The report emphasises the Expert Group's belief that the content of information services is fundamentally more important than the carriage or transport of those services.

It notes too, that it is in the area of content that the greatest opportunities lie for Australian enterprises and further, that it is in content rather than carriage, where the greatest profit potential can be extracted.

The report cites a number of start-up Australian companies that are carving international niches in the business of content development and application.

While the major providers of carriage capacity will initially be the carriers Telstra and Optus, ATUG has long held what had become its traditional view that the carriers, especially Telstra, should concentrate on providing Australians with the most up-to-date digital communications networks in the world and that they should stay out of the content business. Clearly, the world has moved on since that view was formed and ATUG has recently taken the position that any joint venture into content is clearly the carriers' business, and so long as there are no hidden cross subsidies, which might adversely impact on telecommunications tariffs, we would raise no objection.

In this regard, it is worth noting that the Expert Group sees subscription television as the main impetus for current broadband developments and that these services could provide a revenue stream to fund the upgrading of the network.

The group estimates that implementation of the five stages for broadband services evolution, between now and 1998, will cost in excess of $10 billion.

The Future

The Expert Group is halfway through its study and can be expected to provide its final report about the middle of next year. ATUG Director, Allan Horsely, represents the business user community on the BSEG, and ATUG will be taking a close interest in developments.

The group will focus now on aspects of wealth creation, equity and access, content creation and infrastructure development, regulatory framework and infrastructure costs. The work of the Expert Group and that of Communications Minister Michael Lee's Telecommunications Advisory Panel, on which our Chairman George Maltby represents ATUG, will very largely determine the converging communications future for Australia.

Wally Rothwell
Executive Director

Formulating Strategy in an Evolving Industry

As this magazine reaches your desk or lounge chair, planning will be well underway for the ATUG Strategic Retreat, held around October each year.

The idea of formulating strategy for an industry evolving at the rate of the Australian telecommunications industry is a challenging one. It is especially challenging for ATUG because ATUG's strategies largely depend upon the actions of others. Our organisation is the industry's voice; it is not a carrier, a supplier of equipment or services, nor a regulator, in this way it has no 'arms' and no 'teeth.' Instead it relies on the support of members and the power they give it. Changes suggested by ATUG rely on the strength leveraged from, and on behalf of, member organisations to persuade those who can influence the desired outcomes into making these happen.

The strategic planning process that ATUG goes through is therefore not an easy one. It relies upon the members of the board and executive to have maintained an ear constantly tuned to the thoughts of members, whilst their eyes need to stay attuned to the moves and positioning of the players.

Preparation for the development of strategic plans necessitates the examination of existing policies to ensure consistency. At last year's Strategic Retreat, certain policies and related strategies were developed, others were revisited. Some of the desired outcomes have already been achieved, whilst other policies and associated strategies may no longer be applicable given the changes that have occurred in the marketplace, and others have yet to be developed. Some of the policies and associated strategies which will be reviewed follow.

General

ATUG will continue to promote fair and open competition in the Australian telecommunications industry and oppose anti-competitive practices. The end sought is to achieve the best possible services at the lowest price consistent with sustainable competition, thus forcing prices closer to costs.

In this process, ATUG recognises the need to encourage service providers to compete in the marketplace, to keep the general carriers efficient, and to control the evolution of future general carriers.

Full Competition in 1997

To ensure that Australia has full and open competition in the telecommunications industry in 1997, ATUG believes a number of changes must take place.

ATUG would like to see structural separation of Telecom into two parts:

- An infrastructure provider; and
- A separate service provision body.

The infrastructure provider should ideally have separate accounting for different geographic or regional areas to enable performance to be compared. The provider should offer equal access to all service providers (including Telecom) in making capacity available. The infrastructure provider would not have a monopoly.

ATUG would like to see additional 'restricted' carrier licences issued in 1997. Such carriers could purchase capacity (black fibre) from infrastructure companies, use unlimited distance microwave links or satellite capacity, or run cable in existing ducts (electricity, etc.). Property rights would be limited to infrastructure providers.

The part which becomes the service provider, on the other hand, would purchase capacity from the infrastructure provider.

Convergence

ATUG believes that legislation for telecommunications, broadcasting, and radio communication should be amalgamated. Projects should favour services enhancing national productivity, such as data services for business rather than entertainment.

In years gone by, governments encouraged technological developments by funding defence or scientific projects. These developments in turn produced spin-offs for domestic use. With enhanced data services (superhighway-type products) the situation is likely to be reversed, i.e. the infrastructure and technology will most likely be developed for Pay TV. ATUG is confident that these in turn will produce spin-offs for medical and business applications by providers of enhanced business services.

Minimum Sustainable Telecom Tariffs

ATUG policy is to ensure the availability of the widest range of high quality international services at the lowest prices through healthy competition, taking into account the need to protect Australia's international trade balance.

Personal Communication Systems (PCS)

The philosophy behind PCS is that 'it will provide the ability to communicate anywhere, any time, with anyone, according to individual needs,' or at least that is Austel's definition. Whilst the introduction of PCS into Australia is inevitable, ATUG believes its introduction should be market driven, not technologically or legislatively driven. ATUG espouses the view that there should be only one international PCS standard and that proprietary and/or national standards should be discouraged.

Number Portability

Portability of telephone numbers is vital to a competitive market. ATUG believes that users should be able to change carriers providing similar services whilst keeping the number associated with that type of service.

Without this flexibility, costs may deter businesses from making changes that may otherwise result in better services and/ or lower tariffs thus enabling the 'first-in' provider to lock in the customer and raise prices as long as the premium is maintained just below the cost to switch suppliers.

Satellite Competition for Domestic Services

ATUG believes that users should be able to access foreign satellites for the provision of domestic satellite services either directly or through resellers as desired.

Rural and Remote Areas

ATUG believes all rural and remote users must have access to, as a minimum, a standard telephone service.

ATUG has developed what it believes is an appropriate definition of a standard telephone service which should be available to all Australians. As a minimum it must:

- Provide the user with constant access to the PSTN. It must also enable the user to make and receive local, trunk, and international voice grade telephone calls 24 hours a day, with access to automated local, trunk, or international dialling or an operator-assisted international call facility.
- Include a unique telephone number and an appropriate directory listing (if desired) for that number.
- Provide security so that all users can conduct business and personal communications with confidence in their privacy.

- Provide the grade of service capable of efficiently carrying a G3 facsimile transmission.
- At the customer's request, require a carrier to provide an itemised monthly bill for the service.

International Resale

ATUG believes that carriers should provide the widest range of high-quality international services at the lowest sustainable prices, taking into account the need to protect Australia's international trade balance.

Carrier Relationships

ATUG will always endeavour to maintain consistent and professional relationships with carriers and service providers.

The aim will be to ensure that carriers and service providers are responsive to users' needs, are efficient, and market forces are seen to provide healthy sustainable competition. ATUG will monitor the performance of the carriers and users' perceptions of them — especially policies, programs, products, services provided, quality, industry development, and the level of Australian ownership.

Carrier Tariff Information

The tariffs of all carriers, especially Basic Carriage Services (BCS), and Higher Level Services (HLS) should be made public as promptly as possible. ATUG will seek early access to information from the carriers about new tariffs and proposed changes to existing tariffs.

Pay Phones

ATUG believes public pay phones should not be a facility offered exclusively by the general carriers. It is in the user's best interest that 'anyone' should be permitted to operate a public pay phone.

Interconnection and Access

Connection to the national network should be available at cost-related prices (without discrimination) to private networks and service providers who in turn, ATUG believes, have an obligation to offer to their users facilities of a technical standard equal to or greater than the level available to them.

Carrier/Service Provider Interconnection Signalling

Calling Line Identification (CLI) must be generally available to all carriers and service providers to enable them to bill their customers.

Calling Number Display

ATUG considers that Calling Number Display (CND) should be generally available but that calling parties should be free to opt out on a call-by-call basis.

Common Channel Signalling

Common Channel Signalling Seven (CCS-#7), or an equivalent, should be made available equally to all licensed service providers in the longer term. In the meantime, access to facilities required by service providers should be made available on primary rate ISDN.

National Numbering Plan

ATUG believes the new Numbering Plan must be implemented so that it supports the pro-competitive aims of the Government. Within the limits of economic and technical feasibility, users should be free to change their suppliers of telecommunications services without the need to change their telephone numbers.

Price Caps for Non-competitive Services

Price-capping on non-competitive services should be maintained whilst a carrier is considered to be dominant. ATUG will continue to play a pro-active role in price control arrangements and the determination of market and dominance issues.

Directories and Operator Assistance

- White Pages directories should be available for every number allocated for telephone and fax services. Separate free alphabetical directories should be available for radio-mobile services, information and data services, and telex services.
- Customers should be entitled to a free entry for every line or service leased.
- Telephone service customers leasing multiple lines should be entitled to a free directory listing for each exchange line. ATUG is of the opinion that this right could be traded for a reduced line tariff or free bold entries.
- General carriers should continue to provide free operator and directory assistance to customers.

Local Industry Development

ATUG supports a substantial role for Australian industry in the supply of equipment and services to carriers, Service Providers, and users. ATUG especially supports the Federal Government's IDA and Partnership for Development programs and TIDA.

Standards

Through its representative on Austel's Standards Advisory Committee and through the participation of ATUG's representatives on ITU-T and other committees, ATUG will flag a pro-active role in developing Australian standards. The thrust will always be for cost-effective and user-friendly standards and — where possible — adoption or adaptation of international standards.

Pay TV

ATUG believes the choice of delivery systems for Pay TV should be left to the commercial marketplace. Options available will include satellite, cable, UHF, and MDS radio systems. Delivery coding systems should be standardised and universal where technically possible.

Frequency Spectrum Management

Australian frequency assignments for all equipment should take account of international usage (and conform to it as far as possible) to maximise the potential for export benefits for locally manufactured products and to allow Australians to use equipment manufactured for larger international markets.

Those policies described above along with many others will be reviewed, reworked and put to work for the best overall interest of members.

Frame Relay Seminars

The Frame Relay Forum is conducting a new series of Education Seminars. The major emphasis will be on real-life applications of frame relay, case studies from users who have, or are in the process of implementing, frame relay networks in Australia and New Zealand, as well as overseas.

Dates and locations for the seminars are:

Sydney	13 October 1994	Melbourne . . .	8 December 1994
Sydney	16 February 1995	Brisbane	1 April 1995

These 'new look' seminars will include a 'Carrier's Perspective' session in which carriers and value added service providers will be invited to detail their existing and planned frame relay services. The meetings will also include a 'Vendors Corner' which will give nominated vendors the chance to briefly introduce new frame relay products and services.

The Forum, with the support of Telstra and British Telecom, will provide videoconference facilities to enable members located in capital cities in Australia and New Zealand the opportunity to participate in each Education meeting. For further information, contact the Frame Relay Forum Secretariat, Tel: (02) 975 2582

The National Numbering Plan

With the first stages of the new National Numbering Plan being implemented at the moment, it is probably appropriate timing to re-visit a paper given at ATUG'92 by Jim Lynch, Manager Market Analysis, Ericsson Australia Pty Ltd.

The need for the implementation of a National Numbering Plan is both inevitable and inescapable.

1. Australia is running out of telephone numbers;

2. Telephone deregulation is about to provide all Australians with a new range of choices, and making those choices will, in many instances, require the use of carrier access codes. New services such as GSM cellular telephone technology are likely to require the allocation of discreet number ranges; and

3. The need is further compounded with increasing levels of discussion about various levels of portability:

- Telephone number portability . . . from one suburb to another . . . city to city . . . state to state;
- Carrier portability . . . enabling users to change service from one carrier to another, without the need to change the telephone number;
- Personal telephone numbers . . . the telephone number that follows you . . . intelligent networks that enable you to be reached wherever you are, with a single call.

The sum of all of these factors is that Australians are going to need access to a far wider numbering range. Change is therefore inevitable.

ESTIMATED COST TO THE NSW GOVERNMENT OF THE NEW NUMBERING PLAN

ITEM	BASIS	COST
New Government Directory	Publishing and promulgation of major edits	$250,000
PABX Reprogramming	Reprogram system STD numbers (Note: STD is normally barred) $1,000 per PABX (1,200 PABXs)	$1,200,000
Signage	$500 for 2,000 sites	$1,000,000
Advertising	$750 for 2,000 numbers	$1,500,000
Stationery and Business Cards	$65 for 125,000 numbers	$8,125,000
		$12,075,000

Adjusting to Change

The purpose of this paper is not to discuss the merits of either the change, or of the processes that are being employed in effecting that change.

If we accept that change is inevitable, the next step is to make sure that we adjust to that change with a minimum of fuss.

It's an adjustment process that Ericsson Australia has begun to plan for. The purpose of this paper is to provide an overview of the planning processes that need to be considered by Australian businesses in the lead up to the implementation of the National Numbering Plan.

Community Reaction

The New South Wales Administrative Services Minister, Anne Cohen, has expressed concern that Austel is moving too fast. She has spoken of the "unnecessary haste to convert to the new plan."

It would seem however, that increasingly the availability of telephone numbers cannot wait. In one of the Austel case studies, an area of Brisbane with one million available numbers has just 10,000 numbers left for future expansion, and to meet second carrier needs.

The Minister also raised the issue of cost, which, using the figures outlined in the table on this page, the New South Wales Government estimates at more than $12 million.

The Benefits of Planning

It is the author's view that the majority of these types of costs to business can be minimised by careful planning.

The Communications Manager of one of Australia's largest corporations made comment at a recent Austel consultation session that without careful planning, his company's viability would be put at risk.

Certainly, planning is critical, but in looking at some of the planning processes that need to be addressed, Ericsson Australia does not purport to be an organisational expert. This paper is simply an overview of the planning processes that are already underway within the company.

At Ericsson, the responsibility for this process does not rest solely with the communications manager. It is a mix of communications and administration. It is the company's belief that, for the majority of Australian organisations, the communications side of the equation will be the smaller of the two.

An Important Consideration

As the new Australian National Numbering Plan is gradually introduced in each centre, Austel is planning for a 12 month, phased introduction.

For the first six months, callers will be able to dial either telephone number. For the

ATUG Legal Line Service

Members should take advantage of ATUG's Legal Line Service. The service is run by ATUG director and chairman of ATUG's Legal Sub-committee, Gerald Wakefield.

Members with legal queries regarding international telecommunications law and regulatory policy; radiocommunications; broadcasting and satellite law and policy; computer technology law; and intellectual property law are invited to consult this communications legal advice service by calling ATUG on (02) 957 1333.

Telecommunications Act on Disk

The new EIS Electronic Law Book now includes all the updates to the Telecommunications legislation along with Broadcasting and Radiocommunications legislation.
The publication, on a floppy disk, is available to ATUG members at the special price of $150 including postage and packaging — a saving of $50. A subscription including a further two updates is also available for the special price of $295 — a saving of $100.
To ensure that you have the legislation at your fingertips at all times, take advantage of this special offer.
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second six months, callers to old numbers will receive a recorded message.

The Issues — Administration

1. The most obvious issue is that of stationery. Even with planning there is certain to be additional cost, but we advocate a planning process which involves the careful analysis of requirements from one state to another, and the relating of those requirements to the Austel timetable.

Being essentially a State-by-State introduction, for national organisations that publish key telephone numbers on all brochures and product flyers, it could be necessary to change material on more than one occasion.

There is an inescapable cost, but the logistic skill will be in minimising that cost.

2. Beyond the obvious printed material, larger businesses will need to examine internal telephone directories.

Ericsson is adopting the view that these number changes are providing an opportunity to re-examine company procedures.

As an example, now may well be the time for business to consider the possibility of a computer database telephone directory.

3. Customer files need to be updated. These range from computer-based to card-based and teledex files.

4. Many businesses will need to consider mail-outs to their customers.

5. It may be necessary to consider paid advertising, such as cross-referenced entries in the various telephone directories.

6. Promotional products which currently carry telephone numbers will also need to be changed.

The Issues — Communications

1. At the very least, every Speed Dial Telephone will need to be re-programmed.

2. In the worst scenario, some very old switchboards cannot be modified to accept 10-digit numbering. Now may be the time to consider replacing that equipment. This may not be easy in recessionary times, but it must be considered.

3. For owners of latest generation PABXs, with facilities such as Number Analysis (and associated telephone barring), Least Cost Routing, and Common Abbreviated Numbers, this equipment will require re-programming. In some instances such as national networks, that will be quite demanding. It is conceivable that because of the progressive implementation, PABXs may have to be re-programmed at each stage of the total Austel project.

4. There is a wide range of peripheral products that will need modification. These include Call Logging Equipment, specialised equipment used in direct marketing involving database and telephone system interfacing, and wherever a company on-charges the cost of telephone calls, such as hotels, law firms and accountancy practices.

Supplier Responsibility

Ericsson has a strategy in place of addressing the PABX logistics with its customers, and of minimising both costs and customer inconvenience.

It is our view that all suppliers will need to offer a similar turnkey service.

Where necessary, suppliers should be developing appropriate tools to ensure that this is not a difficult process. The timeframe is sufficient to be able to meet those development needs.

It ought not to be a particularly difficult or expensive process. We believe that businesses should approach their equipment suppliers, or communications consultants, with approximately a 12-month lead time.

In some instances, it will be necessary for businesses to drive their suppliers to ensure that the changes will be accomplished as and when required.

The Total Picture

The two major components to these changes involve:

- The impact on privately owned on-site and network telecommunications hardware; and
- The impact on business, including stationery, advertising, 008 numbers, and business contacts.

It will be critical for many businesses to ensure that their customers are thoroughly acquainted with the changes. Failure to adequately address this issue could affect company revenue.

The technology of changing the parameters that drive communications hardware should be relatively uncomplicated.

Reputable consultants and suppliers will be able to address the implications of change, discuss strategies and logistics, and simplify the task.

For some organisations, there can be no such thing as progressive change. With money markets for instance, the changeover will need to be instantaneous.

With the commercial issue it is a matter of administration and logistics.

The sum total of these changes is a human resources issue. If companies apply the resources far enough in advance, the cash cost that organisations like the New South Wales Government are fearful of will be reduced quite considerably.

New Plan Will Serve Australia Well

1. The changes certainly cannot be treated as trivial.

2. Some will see the cash costs as a long term investment in a more orderly telephone numbering system.

3. Of the six-year time span that Austel is proposing for these changes, for customer convenience it would be ideal if the carriers, Telstra and Optus, and the service providers such as AAP, Q-Net, and Vistel, could effect the changes in an instant. That, however, is unrealistic. It will be no small task to modify some five thousand telephone exchanges across the nation.

4. The purpose of this paper is to encourage businesses to start planning the logistics that they will need to address in preparation for the numbering change.

Finally, it is worth remembering that 10-digit numbering should serve Australia for at least 30 years without the need for further change.

September

5-6 **Cable TV and Interactive Services**, Hotel Nikko, Potts Point. This conference aims to provide the most up-to-date and comprehensive information on all aspects of cable television and interactive services. Fee: $1,395. Enquiries — IIR Conferences Tel: (02) 954 5844 Fax: (02) 959 4684.

7-9 **Asia Pacific Digital Cellular Mobile Communications Conference**, Shangri-La Hotel, Singapore. This 4th Annual conference will look at the technological and implementation issues. There is also a one-day seminar n the latest developments in digital technology. Fee: two-day conference $S1,900; one-day tutorial $S876; all three days $S2,211. Enquiries — IBC Technical Services Tel: +44 71 637 4383 Fax: +44 71 631 3214.

25-27 **Who Dun I.T. '94**, Novotel Northbeach Hotel, Wollongong. This event, conducted by the Australian Information Technology Society, covers a range of information technology issues including: linking business planning with IT needs; outsourcing; Internet connectivity; computer fraud; CASE technology in Australia; and the setting of IT benchmarks. Enquiries — Julian Day, AITS Tel: (02) 955 9533 Fax: (02) 955 0099.

25-28 **LETA 94**, Adelaide Convention Centre, Adelaide. This conference, Learning Environment Technology Australia, will explore, explain and demonstrate the effects of new and forthcoming technologies on learning and the way it is undertaken. As well as teaching issues there will be a focus on building design and adaptation to meet new requirements. The event features a wide range of speakers from both Australia and overseas. Enquiries — Tel: (08) 226 1266 Fax: (08) 226 1583.

26-27 **Communications Research Forum 1994**, Hyatt Kingsgate, Sydney. This event, targeted at the research community, looks at current and recent developments relevant to emerging public policy issues in the communications arena. The focus of the two-day conference will be on telecommunications, broadcasting and the radio spectrum, looking specifically at policy-relevant work into economic, sociological, cultural and legal implications. Enquiries — Vickie Richardson Tel: (06) 274 6846 Fax: (06) 274 6816.

26-27 **Mobile and Wireless Communications Conference**, Mount Royal Hotel, London. This event, part of the Mobile Business Show 94, covers technical, marketing and engineering issues in the cellular, wireless local loop and mobile data fields. Enquiries — Christopher Webb, FCS Tel: +44 081 778 5656 Fax: +44 081 778 8402.

29-30 **Telecommuting for Australian Business**, The Regent Hotel, Sydney. This event, aimed at human resources and IT managers alike, shows how telecommuting can reduce overheads, improve productivity, provide better service, and improve business flexibility. There is also a half-day workshop which covers the implementation of a telecommuting pilot. Fee: $1,395. Enquiries — AIC Conferences Tel: (02) 210 5700 Fax: (02) 221 7773.

October

5 **The Internet Forum**, Hyatt Kingsgate Hotel, Sydney. With over half the Internet's component networks now business related, it's vital that managers learn how they can tap into this valuable resource and the opportunities it offers. Key issues addressed will include connecting to the Internet, navigating through Internet menus, using the network as a business tool, and ensuring network security. An optional one-day workshop will focus on important and useful business applications. Also to be held in Melbourne on October 6. Fee: Conference and workshop $1,395; Conference or workshop only, $895. Enquiries — IIR Conferences Tel: (02) 954 5844 Fax: (02) 959 4684.

10-11 **ATM Broadband**, Sydney Boulevard Hotel. This two-day event covers technological trends, early user case studies, ATM migration strategies, carrier implementation, and business opportunities for both public and private networks. Fee: $1,395. Enquiries — IIR Conferences Tel: (02) 954 5844 Fax: (02) 959 4684.

13-14 **Broadband 1994-2000**, Hyatt Kingsgate Hotel, Sydney. This conference is designed to provide technical decision makers with the resources to evaluate the emerging broadband services. Issues covered include market forecasts, anticipating demand growth, applications development issues, and the development costs of new technologies. Fee: $1,395. Enquiries — IBC Conferences Tel: (02) 319 3755 Fax: (02) 699 3901.

19-21 **Asia Pacific Fibre Optic Telecom '94**, Conrad Hotel, Hong Kong. With the Asia Pacific market for fibre optic technology expected to grow to $US4 billion by 1999, this event aims to provide valuable information on the directions and opportunities in this fast-growing region. A range of topics including new services and applications will also be covered. Enquiries — IBC Technical Services +65 732 1970 Fax: +65 733 5087.

24-25 **ATA '94**, Hotel Nikko Potts Point, Sydney. The Second Annual Conference of the Australasian Teleconferencing Association will comprise a comprehensive briefing on practical strategies, standards development, applications and future directions for the teleconferencing industry. As well as recent technological changes, the event will also feature an expert panel of international and local speakers, and nine international videoconference presentations. Fee: $1,395. Enquiries — IIR Conferences Tel: (02) 954 5844 Fax: (02) 959 4684.

25-27 **Australian International Virtual Reality Conference**, World Congress Centre, Melbourne. Australia's first virtual reality conference will be hosted by software supplier Integra, and will feature key speakers and workshops to discuss issues in-depth and offer hands-on sessions. An exhibition will run concurrently with the conference, and will feature both commercial and entertainment-based VR applications. Enquiries — AUSI-VR'94 Conference and Exhibition Tel: (08) 234 1145 Fax: (08) 234 1148.

25-28 **Communications India**, Pragati Maidan, New Delhi. This trade show will display a full range of telecommunications hardware and software in the areas of voice, data, visual display and radio. An associated technical conference will cover cellular mobile, networking and rural telephony. Enquiries — Exhibitions India Tel: +91 11 462 2710 Fax: +91 11 463 3506.

25-27 **Microwaves '94**, Wembly Conference & Exhibition Centre, London. This conference brings together Europe's largest gathering of microwave experts engaged in R&D for telecommunications and civil and military systems. The program covers the entire microwave and millimetre wave spectrum, with supporting RF and software technologies. Enquiries — Nexus Business Communications Tel: +44 322 660 070 Fax: +44 322 667 633.

26-28 **Paging Asia '94**, Marina Mandarin Hotel, Singapore. This conference examines the potential for paging within the Asia Pacific region, which, with its relatively underdeveloped telephone infrastructure, represents a potentially explosive growth area for this kind of technology. Issues covered will include government policies, market deregulation, the role of private operators, and demand projections for the future. Fee: $US1,920. Enquiries — IBC Technical Services Tel: +65 732 1970 Fax: +65 733 5087.

26-28 **Understanding the Telecommunication Revolution**, Savoy Park Plaza Hotel, Melbourne. This seminar provides a practical, plain-English explanation of the telecommunications industry, current and new technologies and applications, standards, network architectures and regulatory issues. For convenience, the course is divided into three separately-bookable days covering voice communications, data communications and emerging technologies, and the event will also be held in Sydney in early November. Fee: all three days $1,795; any two days $1,295; any single day $795. Enquiries — IIR Conferences Tel: (02) 954 5844 Fax: (02) 959 4684

November

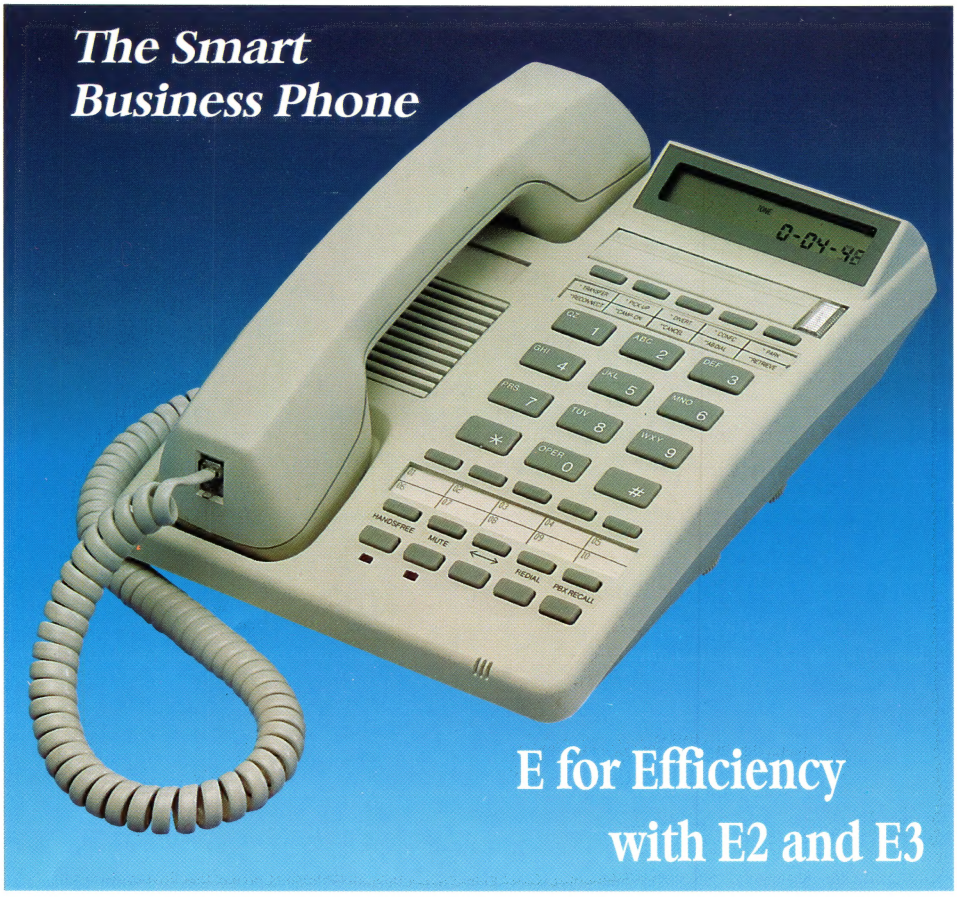
2-5 **Intelcom '94**, Turin, Italy. The Intelcom '94 Conference and Exhibition will this year addresses a wide range of business and technology issues in the communications field. Main topics include broadband transmission technologies, multimedia and use of the local loop to deliver advanced image services like video-on-demand, and backbone and wide area networking issues. There will also be streams on intelligent network applications, tariffing, regulatory issues and new telecommunications services. Enquiries — Adtech Publications & Exhibitions Tel: +44 71 235 8431 Fax: +44 71 235 7841.

5-10 **MANTECH '94**, Pragati Maiden, New Delhi, India. This international seminar and exhibition on the latest manufacturing technologies is organised by the Federation of Indian Chambers of Commerce and Industry. It provides all participating countries with the opportunity to present state-of-the-art technologies in manufacturing, communications and electronics to Indian business, and coincides with the annual conference of the International Chamber of Commerce, which will attract international delegates from 130 member countries. Enquiries — Adesh Goel, PN International Tel: (02) 328 1948 Fax: (02) 327 1975.

14-16 **Pan-Asian PCS '94**, The Hong Kong Convention & Exhibition Centre, Hong Kong. This regional summit focuses on the emerging personal communications services, and will feature top-level speakers addressing such issues as service descriptions, market projections, technology choices and legislative and regulatory matters. A separately bookable fourth day will cover personal numbering issues. Fee: 4 days $US2,495; 3 days $US1,895; Day 4 only $US995. Enquiries — IIR Conferences Tel: +852 549 5618 Fax: +852 547 3836.

December

5-7 **ATNAC '94**, Hilton Hotel, Melbourne. This event incorporates the Multimedia Communications, Applications and Technology Workshop, the Australia Broadband Switching & Services Symposium, and the Australian Teletraffic Research Seminar. The theme of the conference will be 'Meeting User Needs,' and keynote speakers include Phillip Dodds, President of the Interactive Multimedia Association of the US and Leonardo Chiariglione, convenor of MPEG. The registration fee for the three-day conference is $450. Enquiries — Margaret Keegel Tel: (03) 903 2808 Fax: (03) 903 2805.



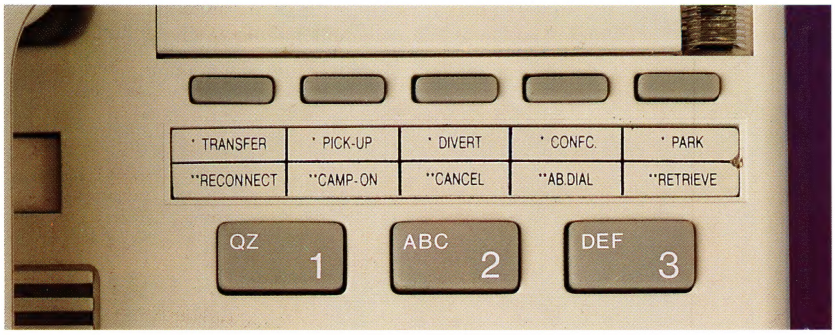
IQTEL E3

- Liquid crystal display
- Clock
- Handsfree / conference operation
- Adjustable earpiece and handsfree speaker volume
- Line powered
- Memory capacity 20 Telephone numbers or PABX commands including 10 numbers with non-erasable Eeprom insertion
- Soft touch number key pad
- Colour Grey

IQTEL E2

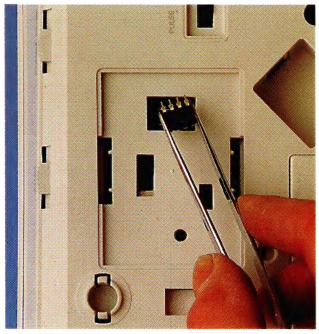
On Hook / Monitor Dialling Version

The following feature is optional



These phones not only look good, they will help you through the business day.

Easy to identify, easy to use PABX or carrier network facilities.



We fit this optional, specially masked Eeprom, permanently pre- programmed with your PABX or carrier network facilities

Maybe it is just checking the time or a telephone number being dialled from the display, talking handsfree or dialling on hook, phoning a colleague with one key touch or instructing the PABX or carrier network facilities to "call forward" your calls by one touch of a memory key. Whatever your job is, you will find E2 or E3 a very dependable workmate.

E2 and E3 can be purchased with customised pre-programming of PABX or network services such as Centel/Customnet/Centrex facilities as illustrated on the left of this page. The pre-programming is on a permanent basis, and will result in all staff being able to easily identify and use the PABX or Carrier facilities. The training time of staff in telephone feature use can be greatly reduced or even eliminated with E2 and E3.

E2 and E3 are not only business phones, they are ideal for home use when purchased with Telecom's "Easy Call" facilities pre-programmed into Eeprom memory for one touch activation.

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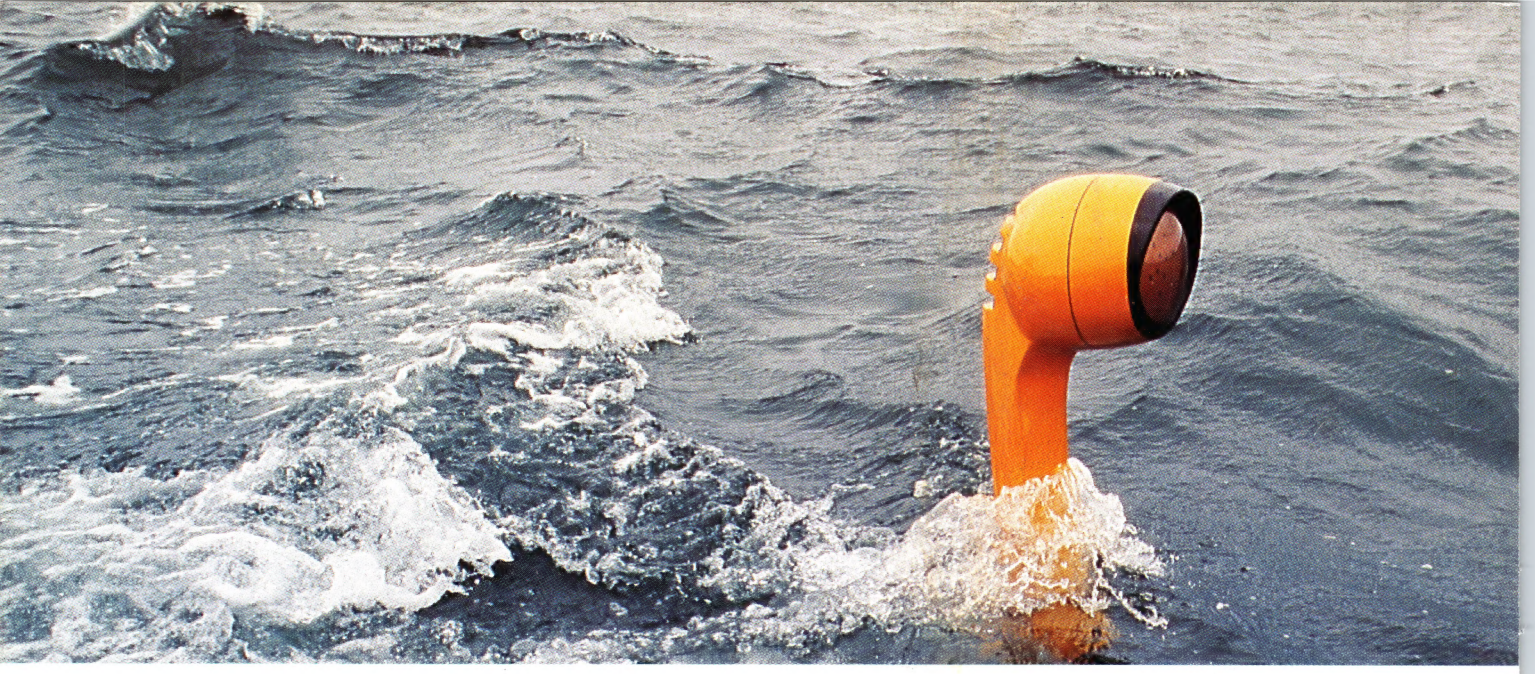
Sydney Phone: (02) 875 4011 Fax: (02) 875 4146
Brisbane Phone: (07) 808 8008 Fax: (07) 808 8080



What we've sunk into the Pacific is earning millions for Australia.

Alcatel is helping to ring the South Pacific with thousands of kilometres of optical fibre submarine cable. Most recently these cable systems were laid on the seabed linking Australia with the USA and Europe.

Another cable stretching from Australia to Guam will complete the South Pacific network. Some 16,500 km in all, it's helping Australia get better connected with the rest of the world. These cable systems carry up to 100,000 telephone calls simultaneously. And because Alcatel is making more and more for world markets, it signals not just a new era in communications, but also a multi-million dollar boost for Australia's economy.

So while you can't exactly see the work we're doing, the benefits are sure to surface.

Alcatel Australia. We're Australia's largest communications company because we know how to compete worldwide.

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